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TRANSLATION

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PORTABLE DRILLING RIG FOR WATER WELLS

(With 4 illustrations)

By: G. GOROKHOV, Lt Colonel, Engineer

Pages 21-25

Today, in addition to the AVB-3-100 drilling machine, engineer subunits are using the URB-3AM, a new portable rig for rotary drilling of water wells. This rig is for the boring of prospecting and exploitation holes in depths up to 250 m to be cased with tubes of 168 mm external diameter.

The main mechanisms of the rig are mounted on the chassis of an MAZ-200 motor vehicle (Figure 1, a,b), and they are actuated by Engine 1 which is an SMD-14-B of 62 HP. The drilling tool, casing, slush circulating pump, mud mixer and the rest of the accessories are carried on an MAZ-200-G and an ZIL-157 motor car which are specially outfitted with an 1-APM-3 log-trailer (the trailer pole can be lengthened).

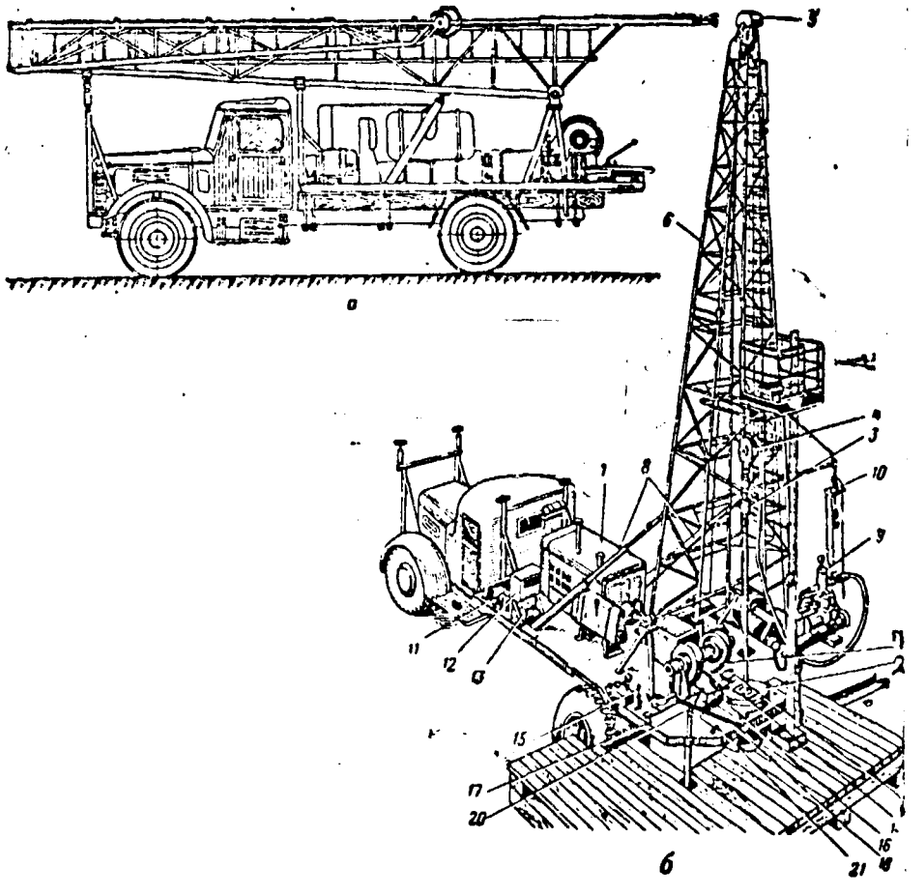


FIGURE 1: Overall view of the URB-3-AM drilling machine: a) over-the-road view; b) working position.

The string of rods is rotated with Rotary 2. The driven gear of the rotary is fixed to a table. Wedge and bushing is inserted in the 250x250 mm square throat of this table. The bushing also has a square aperture. The rotation of the 8m long square working rod (=kelley) is transmitted through this aperture. The length of the working rod can be gradually increased as the well is growing in depth and is cased with tubes of 6 to 6.5 m length. The working rod is connected with Swivel 3 which is suspended on 15.5 -mm wire rope. Fastened at its one end to the drum of Hoisting Apparatus 7, the rope passes over Crown Block 5 of Tubular Mast 6, and over Travelling Block 4, forming a tackle with a triple pulley block. The hoisting power of the apparatus is 3 tons on straight wire, and 7.5 tons on the tackle.

The mast derrick is 16 m tall. It has a load-bearing capacity up to 10 tons. The mast is retractable; it ascends and descends by means of two Hydraulic Telescopic Hoisting Jacks 8. A double-acting Slush Piston Pump 9 (trade name: 11-G) serves for flushing the well. Its output is 300 lit./min. under 63 atm. pressure. There is a Two-Ton Tackle 10 on the mast; with its help the slush pump is transferred from the transporting motor car to the platform.

The pump collects mud-laden fluid from the circulation system, and carries it by a delivery hose to the swivel. Then, the fluid runs along a channel inside the working rod, along the casing pipes and through an aperture in the drilling bit it comes out on the drilled face. The mud-laden fluid is prepared in a mud mixer which has a tank of 0.75 m^3 capacity. Its electric is fed with current from Generator 11 whose drive is provided by a V-belt drive SMD-14-Bongine. The electric motor of the mud mixer is set in operation by closing a packet-type switch on Electric Switch Board 12. Voltage is regulated with a starting Rheostat 13.

In the channels of the circulation system, the fluid is cleaned from rock. The control levers of the drilling rig are around the rotary, at the driller's post. They function as follows: 14 --- shifts the drive to reduce or to increase the speed of the drilling tool's rotation; 15 --- puts the slush pump into operation; 16 ---engages the rotary and the hoist apparatus; 17 and 18 ---control the friction clutch and the hoist brakes. The levers of Rotary Stop 19. Clutch 20 of the engine, and Fuel Control 21 are also at the driller's post. The oil-pump control lever is on the body of the pump on coupling under the engine hood. The diagram of mechanism (Fig.2) shows the connection of the rig's main points with the SMD-14-B engine.

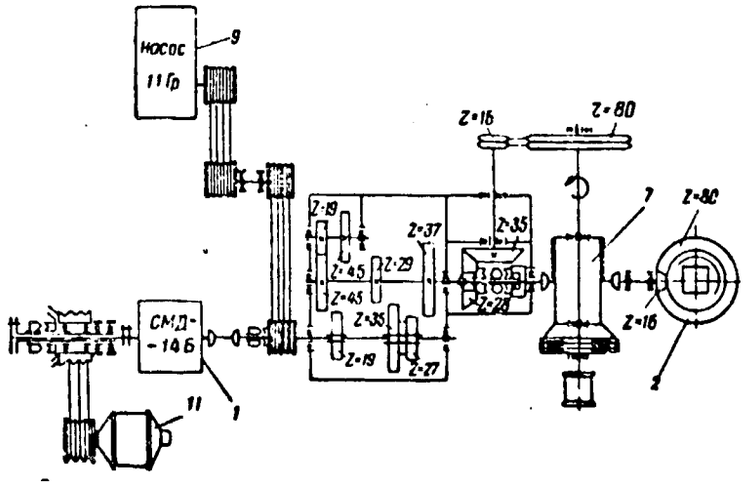


FIGURE 2: Diagram of the rig mechanism.
(Upper left: 9...Pump; lower left: 1...SMD-14B)

The drive or the toothed clutches can be engaged and all mechanisms can be put into operation only when the friction clutch of the engine is disengaged.

The drilling crew consists of five persons:-- the crew commander (who is a master driller himself), and four drillers. Three of them are drivers for the drilling vehicle and the two transport vehicles.

After the place was selected for the well construction, the drilling rig is deployed from its travelling position into working position (Fig.3).

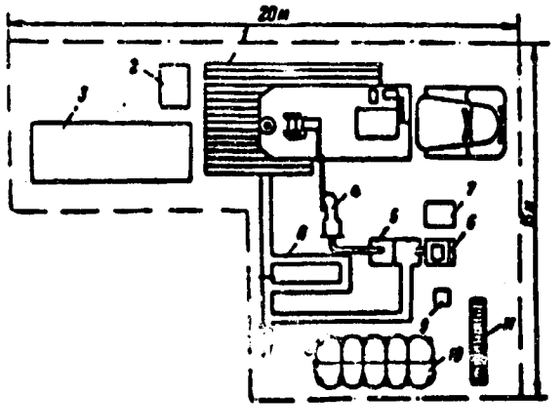


Figure 3. Diagram of the deployment of equipment: 1...scaffolding; 2...emergency drilling tool; 3...casing; 4... slush pump; 5...reception tank; 6...mud mixer; 7...mud storage; 8...circulatory system; 9...LGR-3 laboratory for determination of the quality of the mud-laden fluid; 10...RE-6000 container; 11...box with selected samples.

If no metal or wooden troughs or channels are available, the circulation system is organized on the ground; a few ditches 0.3 m in width and 0.2 m in depth are dug for a length not less than wo m. To force the washing fluid of the well into the circulatory system, a conductor (Fig.4) or a metal chest is inserted in the well mouth.

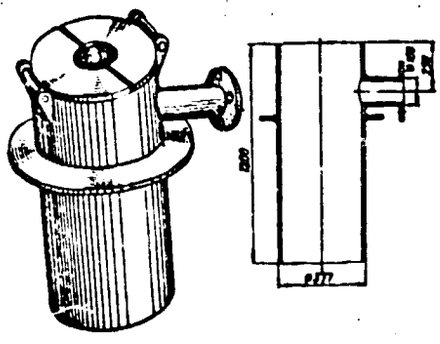


Figure 4. Conductor

A 1.5 x 2.5 x 1.2 m^3 pit is excavated for the reception tank. The tubes for casing are laid upon a wooden-beam support with their couplings on the side of the drilling machine, while the drilling and emergency tool is placed on a 1 x 2m^2 wooden board. The water needed during drilling is stored in the RE-6000 container.

Before the commencement of drilling, all mechanisms of the drilling machine must be tested and lubricated, and the tools must be checked.

After engaging the first drive, the drilling begins (the number of revolutions of the rotary should not exceed 110 r.p.m.). The slush pump is set into operation at the same time as the rotary. By the way, the drilling tool should press against the drilled face in free-fall (by its own weight). After the depth of the well reached the length of the working rod, the rod is withdrawn, and the collared casing is connected to it. In this case,

after disengaging the rotary and the slush pump, the hoisting apparatus hoists the rod until the drilling bit comes out of the well. The well mouth is covered and the bit is unscrewed. Then, the rod is hoisted again until it comes out of the rotary. Its lower end is placed upon the scaffolding (Fig.3) while its upper end is guided into a storing stand (on the side of the derrick), and the travelling block is separated from the hoist. After fastening the casing by an elevator, the casing is hoisted by the hoisting apparatus. It is let down into the rotary's throat, and the drilling bit is screwed to it. Then, it is lowered into the well until the elevator reaches the table of the rotary, and stops. Now, the working rod is hoisted, and screwed together with the casing. The elevator is removed, and the string of rod and casing is lowered into the well.

Further on, the string of rods is built up in the following way. One end of the casing is connected with the working rod, the other end is connected with the top of the drilling string. At the moment of addition, the casing next in line should stand ready, with its thread lubricated. Before each addition to the casing, the well must be thoroughly washed. To avoid any wedging of the drilling bit during descent, the preparation of the well should begin 4-5 m above the drilled face. The drilling bit should be evenly applied to the face, without any jerky movement. The drilling of the well must continue through all hours.

Only in such a case is drilling not permissible when the tool vibrates up and down. Such vibrations can be eliminated either by reducing the load on the drilling bit, or by reducing the speed of the rod ratation. The slush pump must always work at its maximum efficiency during drilling. At certain time intervals, depending upon the type of rock, the drilling bit should be raised 0.5 to 2 m above the drilled face. Then, with continued rotation under strong flushing, the bit is again slowly lowered upon the face.

If drilling is discontinued for any reason, the drilling bit must be raised above the face to the length of one casing tube, while the well must be kept filled with mud-laden fluid all the time.

Maximum driving speed must be aimed at during drilling. Yet, speed should never reach the range where the circulation system would be unable to cope with cleaning the fluid. The URB-3-AM machine will drill wells in sandy soil at an average rate of 12 m/h, in sandy loams at the rate of 6 m/h, and in gravelly soil at the rate of 0.5 m/h.

Drilling is completed as the water-bearing layer (=aquifer) is opened. In loose rocks the well is carried as far as the water resistance. In fissured rocks, after the aquifer was uncovered, even a 2-3 m additional depth of drilling is satisfactory.

The drilling shaft is strengthened by casing. On the string of tubes a filter is installed in the zone of the aquifer. In fissured rocks, filters cannot be installed.

In working with the URB-3-AM, sometimes there is need for manufacturing a conductor on the drilling site (Fig. 4). It will also happen that, in rigs working on SMD-14-B engines, vibration will ruin the oil tubes at their inlets and outlets. Such a defect can be prevented in the following way. Cut off the oil tubes around the radiator, and connect them with durite hoses of 150 mm length; the diameter of the hose should be 14-16 mm.

Another defect occurs still in these rigs. The rollers of the hoisting apparatus will not infrequently jump out from the guiding mast. For the prevention of this, rings made of 6-7 mm wire are welded to the shoulder of the rollers. In spite of these technical defects, the URB-3-AM rig possesses high qualities for exploitation. Thus, wells of 100 - 120 m depth are constructed in 2-3 days, while a 150-250 m deep bore hole requires 4-7 days of drilling.

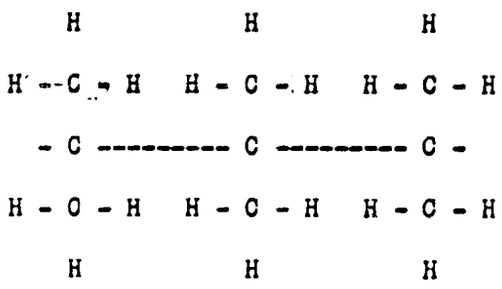
SILICON OILS AND LUBRICANTS.

By: M.MARKETOV, Lt.Colonel,Engineer
Pages 24-25

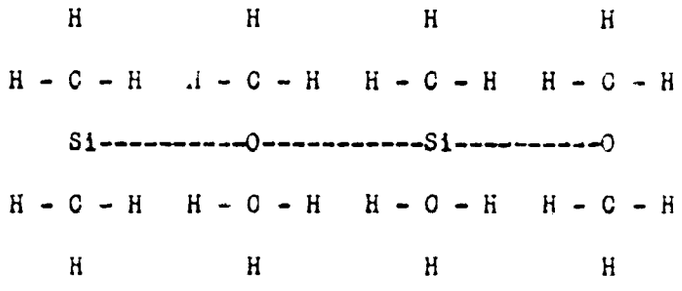
Oils, lubricants and fluids prepared with silicons are many times better than the same petroleum products. They are widely used in many industries, such as the petroleum, chemical, resin, pharmaceutical, electric engineering, automobile, aviation, coal and glass industries. Silicon fluids are used for making waterproof materials, protective covers, washers. They are used for impregnating electric insulating materials, for polishing plastics, leather and glass.

Let us see how these oils and lubricants are made and what their properties are.

It is well known that river sand consists of one silicium atom and two oxygen atoms. Its chemical formula is this: SiO_2. Structurally it can be written as O = Si = O. Hydrocarbons derived from petroleum have a more complicated structural formula:



If in this compound one carbon atom is exchanged with one silicium atom, and another carbon atom with one oxygen atom, then a new substance is obtained which is called silicon. Its structural formula looks like this:



In this compound, silicium atoms (Si) alternate with oxygen atoms (O). The length of molecular chain decides the properties of the silicon fluids. To obtain such fluids is very difficult and time-consuming. It requires complicated equipment and high qualifications in those who are engaged in their production.

The silicons are colorless and transparent fluids. They are unconcerned with high or low temperatures, i.e., long exposures to low (-70°C) and high (+250°C) temperatures do not alter their properties. At temperatures higher than +250°C the silicons will quickly oxidize. They become carbonized, and a solid sand-like substance will result. Silicon fluids evaporate only a little, they are not inflammable, and they almost never damage rubber goods. They are therefore used for making special instrument oils, fluids and many lubricants.

Silicon fluids are also never used in their pure form. For the preparation of instrument oils, they are mixed with petroleum oils. In a few cases, additives are blended with such mixtures to improve their properties.

It is generally known that the viscosity of ordinary petroleum oils much depends upon the temperature at which they are used. As the temperature drops from +100°C to -30° the viscosity of these oils increases 1500 times. At the same time, under similar conditions, the viscosity of some silicon oils is increased only ten times. This property makes the silicon oils and fluids irreplaceable in the operation of such assemblies and mechanisms which work within a wide range of thermal changes. Silicon fluids are especially suitable for lubrication of airplane instruments and other aviation apparatuses.

Silicon fluids are also used for making lubricating greases. They are used in the liquid phase. Different soaps, in some instances graphite and even soot serve as lubricant stiffeners. In the ordinary lubricating greases, mineral (petroleum) oils provide the liquid phase.

From silicon fluids, working fluids are prepared for hydraulic shock absorbers and other hydraulic structures.

Silicons are also used as antifoaming additives to motor oils. It is enough to add only 0.01% silicon to the oil to prevent foaming in the engine's lubricating system. Another valuable feature of such additive is that it is very resistant to oxidation.

* * *

PRACTICAL WORK IN "No.1 MAINTENANCE"

By: M.PERVUKHIN
Pages 33-35

We share the opinion of Engineer Major V.KARPOV (*Technology and Armament, 1963, No.1) that practical instruction of students should start from the very first days of study, and it should not be limited to scheduled special practical exercises only, but it should also continue during all class-work in technical preparation as well as in the course of maintenance provided for the tanks after operations.

Let us consider how good it is for instance to organize exercises in the subject of "No.1 Maintenance".

For this subject, six school hours are allotted. Five of these are for practical works. To begin with, during one class-hour, the tankdriver students learn the volume of work, and chiefly the ways and regulations how to carry out maintenance operations. Well then, even for the work conducted in a special class (**A.RYMARENKO: "Class of Tank Operation". Technology and Armament, 1962, No.12) or in a maintenance park, books and diagrams as well as maintenance equipment must be used. At that time, the leader can also explain and display to the students in which order the basic operations are accomplished. For making this easier, training-section commanders and tank-driv driver instructors are selected, and they are trained in the methodology of instruction.

The five-hour practical work is conducted on tanks subject to No.1 maintenance. Thus, nothing is left to conditions or suppositions. It is desirable to allot so many tanks to a training platoon that no more than 4 to 6 students should work on any one of them.

Two subgroups, composing a crew (See CHART), are working on a tank. Each of them carries out all the No.1 maintenance operations. This is possible because many times the subgroups don't do the whole operation simultaneously, but only a part of it. For instance, one subgroup tightens the left caterpillar track. The other tightens the right track. Some of the students refuel the middle container, while others refuel the forward container. This method also permits that each trainee acquires practical habits.

It is very important that training in the maintenance of armored equipment be conducted according to Army-approved technology. Thus, at a fueling point the tank is fully refueled with fuel and oil, at an appropriate point the cleaning and washing is carried out, and the cooling fluid is also supplied at the same point. Inside cleaning, checkup on the condition and maintenance of the assemblies and mechanisms happens at a maintenance point. At a parking place finally, the tank is cleaned and covered with tarpaulin.

Students are trained and their activity on each tank is supervised by the tank-driver instructors and the training-section commanders. They give the students assignments in tank maintenance according to the Chart, and they shift them from one working place to another. But their primary function is to teach the students in tank maintenance according to the operating chart and in the correct use of instruments, accessories and equipment, as well as in the strict observance of technical requirements. They are not to use the students as an auxiliary force, but to teach them how to detect and to remove defects in tank assemblies and mechanisms which appear during maintenance time. It is very important that the students be correct in using technical terms. The instructor's duty is to take stock of the performed work of instruction, to evaluate it according to standards, to observe safety measures.

It goes without saying that at such work the students will acquire only the initial elements of habits which must be further perfected in the course of each new tank maintenance, and in all the exercises with the material portion. For instance, for exercises in driving, it is advisable to organize a training place for maintenance and for elimination of defects with the utilization of a ZIP (= spare parts, tools and accessories) kit. Therefore, organization of practical work is just as necessary as organization of planned instruction. The difference is only that in each subsequent maintenance the student carries out different functional duties and, thus, after the period of training, he has assimilated all maintenance operations, he developed firm habits.

SAMPLE CHART OF EXERCISES IN No.1 MAINTENANCE

FOR TANK-DRIVER STUDENTS

(See chart on next two pages)

Time in minutes	Works performed by the students	
	I. subgroup	II. subgroup
20	Refuel tank with oil	Refuel tank with fuel and clean openings in plugs of fuel nozzles
40	Refuel tank with fuel and clean openings in plugs of fuel nozzles	Refuel tank with oil
60	Take tank to point of cleaning and washing. Clean and wash tank from the outside	
65	Refuel tank with cooling liquid.	
70	Tidy up the cleaning and washing point. Take tank to point of technical servicing. Check work of engine and indications of control instruments	
75	Move the tower left(right) by 90° / Open hatch in removable roof plate	Lift cover over radiator and the radiator
85	Clean driving compartment, fighting compartment, and systems of engine through window in motor's bulkhead. Check for leak in motor system.	Through hatch, clean engine and its system, check for leak in them. Check fastening of cover(head) of air cleaner.
95		
100	Take out vision device of tank driver, clean and lubricate shaft cavity, check work of tank driver's hatch cover.	Through hatch above radiator, clean assembly of power transmission, engine system, check for leaks and whether control hands of turn brakes coincide
105	Check air pressure in cylinders, work of shutters, light in driving compartment, headlights, outside signal, outline lights, lamp and signal of PPO (fire-fighting equipment)	Tighten tracks, check condition of tracks and junctions of running gear (left side)
120		
130	Check fastening of storage batteries and their wire tapping, the hatch of emergency exit	Check hatch cover of tank commander and of the loader, condition and fastening of sighting devices and vision devices, electric triggers, light in fighting compartment and work of ventilators and manual gear of gun
135	Tighten tracks, check condition of tracks and junctions of running gear (right side)	Check packing of ammunitions, gear of vertical guiding of DSHK machine gun. Clean contact device of commander hatch and mechanism of tower's turn
145		Through window, in motor's bulkhead clean system of engine and check for leaks
150	Check hatch cover of tank commander and loader, condition and fastening of sighting devices, and vision devices, electric releases, light in fighting compartment, work of ventilators and of manual gear of gun	Check fastening of storage batteries and their wire tappings, the hatch of emergency exit.
160	Check packing of ammunitions, gear of vertical guiding of DSHK machine gun. Clean contact device of commander's hatch and mechanism of tower's turn	Take out vision device of tank driver, lubricate shaft cavity, check work of tank driver's hatch cover.
170	Through hatch, clean engine and its systems, check for leaks in them. Check fastening of cover (head) of air cleaner. Close hatch in detachable roof plate.	Check air pressure in cylinders, work of shutters, light in driving compartment, headlights, outside signal, outline lights lamp and signal of PPO.

180		
185	Through hatch above radiator, clean assembly of power transmission, engine system, check for leaks and whether control hands of turn brakes coincide. Lower radiator and close cover above radiator.	Turn turret into initial position.
190	Verify condition and fastening of outside packing of ZIP and containers, whether all hatch covers and plugs in tank's hull are airtight.	
195	Clean and pack instruments, equipment, and appliances.	
205	Tidy up technical maintenance point	
215	Transfer tank to parking place. Check work of engine and indications of engine instruments. Finish cleaning tank and close hatches. Cover tank with tarpaulin.	
235		

IMPROVED CROSSPIECE.

(Alligator clip) Page 35

Reliable crosspieces for storage batteries, as shown on the drawing, are rather easily prepared from junk.

Their cone is turned from copper or brass.

Connected to the terminals of storage batteries, they assure substantially strong contact and they are easily removed.

Such crosspieces are best kept available at the charging stations of every tank unit, especially since they can be manufactured at any repair shop.

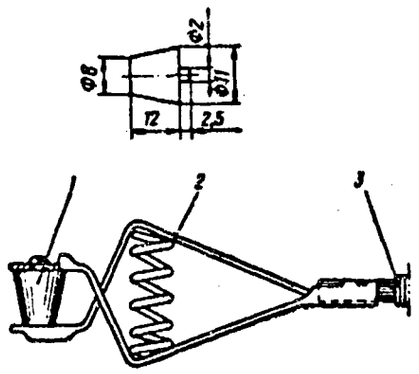


FIGURE (1...cone; 2...clamp with cut-off teeth; 3...conductor).

TRAINING BASE WITHOUT SPENDING THE MOTOR TRANSPORTATION POTENTIALS

(With 2 illustrations)

By: A.KALININ, Captain, Engineer

Page 36

The efficiency experts of our unit,--Sgt.Dolgushin, Privates First Class Belyakov, Potemkin, and the author of the present article, prepared a training apparatus to train tank-drivers in tank driving by the directional gyro (Fig.1)

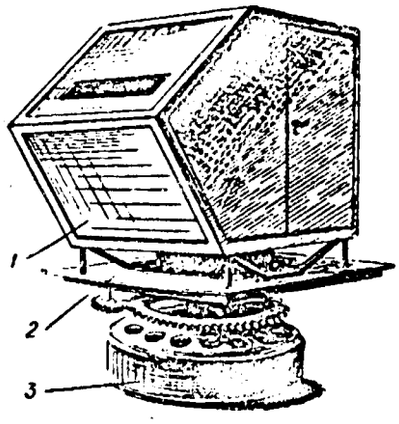


Fig.1. Diagram of Training Apparatus.
1...training booth; 2...turntable; 3...foundation

A steel casing is mounted on an ordinary authorized training apparatus. A curtained window is in the front part of the casing, and a small door on the left side through which the tank driver can be watched whether he is correctly seated in the training apparatus. The booth is lighted. Inside the booth, a directional gyro is placed on a special wall bracket. During transportation, the booth is taken off from the table.

The support of the turntable is a roller with fixed internal gear. The table itself turns by means of electric drive (Fig.2) which is assembled from former operating pieces. The motor of the turret's rotation is an electric engine, and the contacts are slightly changed KS-31 starter buttons. Th These are two-contact buttons, kinematically connected with the controls of the training apparatus.

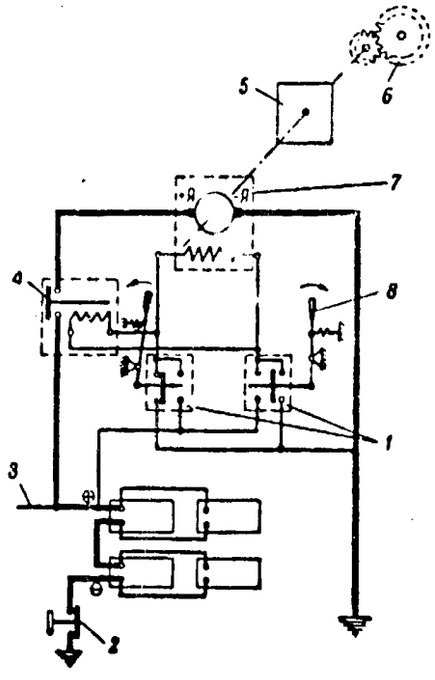


Fig.2. Diagram of the Electric Drive
1...contacts; 2...battery circuit breaker; 3...wiring for directional gyro and lighting system; 4...magnetic circuit breaker; 5...reducer; 6...internal gear; 7...electric engine; 8...control levers.

On the training apparatus the instruction proceeds as follows. At the leader's command, the tank driver takes his place in the booth, and performs all operations necessary to make the tank ready for movement. When he finished the preparation, a command is given: "Direction Toward Reference Point No. So and So". With the turning controls, the trainee brings in line the training apparatus and the reference point on the same plane. He engages and sets the directional gyro, then he closes the peep hole in the curtain.

By pressing one of the control knobs, the leader of exercises sets up an angel of dis-orientation. Thereupon, by operating the turning controls, the trainee resets the original position.

The turning of the training apparatus corresponds to such tank turnings as if the tank would move at the rate of 12 km/h, and the PMP( ) controls were in the first position.

The training apparatus with the directional gyro helps to improve the training of tank drivers in tank driving under complicated conditions, and, above all, it reduces the spending of motor transportation potential on instruction.

"RUNNING FIRE" SWITCHBOARD (FOR SEQUENCE FLASHING LIGHTS)

By: G.OVDIENKO, Captain, Engineer
Page 37

On models set up in training classes, light bulbs connected in a "running fire" (=sequence flashing) circuit will very graphically imitate the movement of fluid or gas.

The switchboard (=commutator) which we prepared makes it possible that voltage is supplied to the light bulbs either alternately or to all bulbs at once (See Figure).

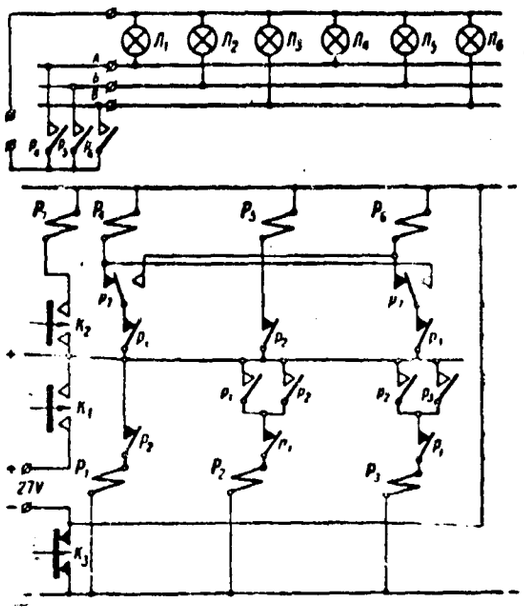


FIG. (Legend from top to bottom) $L_1L_2L_3L_4L_5L_6$
"Change of direction"
"Supply"
"Steady Light"

The essential elements of the switchboard are the slow-release relays P_1, P_2, P_3 of the RKN( ) type. Relay with slow action can be also used. The relay's magnitude of slow release(action) also determines the speed of sequence flashing. The relays are so connected with each other, when voltage is fed on the "+" and "-" bus-bars, the relays begin successively to act and to release in the following order: -- $P_1P_2P_3P_1P_2P_3$ and so on. With their own normally closed contacts, they engage the power-current relays P_4, P_5, P_6 which also tap in the group of light bulbs and the source of light supply.

Any supply source, direct or alternating voltage, is suitable for lighting. But the switchboard itself can be supplied only from a direct-voltage source.

The direction of the sequence flashing can be changed by engaging the key labelled "Change of Direction". Here, Relay P_7 acts and shifts its contacts into the circuits of Relays P_4, P_6. If the power-current relays would interwork in a sequence such as $P_4P_5P_6P_4P_5P_6$, and the light-bulb circuit would create the impression of a flashing movement to the right, then after the engagement of this key, they will act in the reverse sequence $P_6P_5P_4P_6P_5P_4$, and the flashing will run from the right to the left.

Relays $P_1P_2P_3$ are disconnected from the source with the key labelled "Steady Light", with engaged supply. With their own contact these relays

will simultaneously close the circuit of Relays $P_4P_5P_6$ which supply voltage to all light bulbs in the circuit.

After mounting the commutator, the relay's slow-release time is regulated by changing the number of contact springs. If for instance the speed of sequence flashing is not sufficient, additional contact springs are installed on each relay, or tin-foil or paper separators are placed between the relay's armature and core. The greater the thickness of the separator, the quicker the release, and consequently the greater the speed of sequence flashing.

TECHNICAL SUPPORT

CONTROL FIRST AND FOREMOST

By: A.GULYA,Lt.Colonel,Engineer
Pages 38-40

One of the chief tasks of the ubit aviation engineer service is to secure the accident-free work of aircraft equipment. For its success, the basic condition is the daily first-rate preparation of airplanes for flights. This is achieved by the proper organization of checkups. Here are some examples to confirm their very great value.

Under the leadership of M.SINYUKOV, Air Squadron Engineer, Captain, Technical Services, the aviation engineer staff prepared a group of turboprop airplanes for their mission. Once more they rechecked instruments sets, medical kits, spare-part kits and the ground equipment which was needed for airplane maintenance at "strange" airdromes. Engines were tested, the preflight preparation was completed. The aircraft mechanics reported the readiness of their planes.

Airplanes were soaring up one after another. Having completed their responsible work and having removed everything superfluous from the parking space, members of the technical staff were about to leave the airdrome. But at that time one of the airplanes which took to the air reappeared in a landing pattern. The mechanics were perplexed: "What did compel the crew commander to discontinue his flight?"

The airplane landed, and it ran along the runway. And suddenly, unexpectedly to everybody, the landing gear's front leg collapsed, and, after striking concrete with the front end of its fuselage, the machine suffered serious damage.

An investigation ascertained that a day before the scheduled day of flying a team of specialists adjusted the electric signalling system and the system which controls the withdrawal and release of the landing gear. The air squadron engineer relied upon the high qualifications of the specialists, and decided to release the plane without a further check. During flight the electric system failed, and the crew was finally unable to continue the flight.

The quoted example shows what the result will be if the requirements for compulsory multistage checkups on the condition of the aircraft equipment are disregarded. M.SINYUKOV,Technical Services, and his chief, N.BORODULIN, Captain,Technical Services, violated this requirement, due to which a breakdown occurred.

The following case is also instructive. After the regulation works were finished on the engine, the electric supply's socket division for the engine's stop-gear system was not connected. This was known to P.MASHKOV, Senior Lt., Technical Services, who was the airplane engineer, but, while preparing the engine for testing, he forgot to eliminate the defect. I.INYUKOV, Captain, Technical Services, Detachment Engineer, did not verify the quality of works done. As a result, due to burning of the turbine blades, the engine was completely taken out from the formation, since it was impossible to stop it in proper time.

The following case is somewhat different. It occurred in the aviation engineer service which is under the leadership if Engineer Lt. Colonel A. TSIRKUNOV. Correctly organized multistage control will help to eliminate serious shortcomings, which are missed during the take-off preparation

period for the landing of a large group of airplanes. Due to the inexperience of a young engineer, on several machines the locks of fastening loads were incorrectly set. This mistake could have led to the equipment's failure in flight and to failure of the mission. In good time it was discovered by G.MALIN, Lt. Colonel, Engineer, who thoroughly checked the correctness of assembly.

On the basis of many years' experience with maintaining aircraft equipment, control types were established which most efficiently secure the equipment's reliability (See Outline).

BASIC CONTROL TYPES

Continuous

1. During preliminary preparation
2. During preflight preparation
3. Take-off inspection
4. During preparation for repeat take-off

Periodical

5. During regulation works
6. Complex and special purpose inspections:
   during operation;
   --- at acceptance of airplane from
   --- factory or from another unit

SUPPLEMENTAL CONTROL TYPES

7. During depot days
8. At monthly periodical inspections

Control of the aircraft equipment's condition should be 1) continuous --- while preparing the machines for every flight day and for every flight, and 20 periodical---after a certain amount of flying time, and at approximately even time intervals.

The continuous control is exercised during preliminary preparation, preflight preparation, at take-off inspection, and at the brief laying-up before a repeat take-off. In the continuous control system, the chief element is a checkup during the preliminary preparation, after which the airplane is refueled, all exposed defects are eliminated, and the machine is ready for its mission at any time. During the preliminary preparation, the airplane's aggregates and systems, the landing gear hinge joints, the fastening of hydraulic cylinders, the airplane control are most completely inspected; the airtightness of connections in the fuel and hydraulic systems is checked. It is of great importance that the maintenance staff be continuously trained in the methods of inspection.

Most effective is the instrumental method of control. It is used for checking the parameters and working capacity of equipment. Visual control is also conducted as a check-up on hinged joints and junctions. By rocking with the hand, for instance, weak spots in the tightening of hydraulic cylinder heads, eye bolts, hydraulic flexible hose bends and other junctions can be discovered. An useful type of check-up is testing the control system in motion: --one verifier moves the control stick, while another looks

over and listens to the airplane control line all along its length. This type of control makes possible to discover any contact of the connecting rods and control wire ropes with the airplane structure, to verify the smoothness of run, and to expose any jamming.

The preliminary and preflight preparations are related to each other. Inadvertences, missed in the preliminary preparation period, will be detected in the preflight preparation period, provided that the control is correctly organized. In the Maintenance Service Unit, the quality of continuous control can be determined at the time when the regulation works are done. The fewer defects are found on the airplane, the better is its maintenance in the subunit.

In the periodic control system, the chief and most laborious element is a check-up on the airplane's aggregates and systems while the regulation work is done in the Maintenance Service Unit. Therefore, the quality of airplane maintenance in the subunits is evaluated according to the results of these works.

Very effecient are the complex and special inspections which are conducted by the steering technical staff during the operation of materiel. They are previously exposed on other machines or appearing during operation, as well as for establishing the degree of wear and tear in the aggregates, joints and individual junctions of the structure.

Such inspections are of the highest quality whenever special sets of instruments and measuring devices are used for these purposes.

In addition to the basic control types,--the continuous and the periodic type,--supplemental check-ups are also very advisable. They are conducted on depot days, and at the periodical (monthly) inspection of equipment.

In a few units, continuous inspection of all systems of the plane is the basis for the organization of depot days. This makes possible that during a year the difficult spots of an airplane are thoroughly inspected two to three times, which contributes to increasing the plane's operational reliability. Not less important are the periodic examinations of the aircraft equipment, every month they are conducted simultaneously in all subdivisions of the unit. The results of these inspections also show the progress of the unit in the socialistic competition movement for better equipment and better planes.

COMPUTER FOR TECHNICAL SUPPORT

(With 2 figures)

By: M.MARYUTIN, Colonel, Engineer and
S.MIKHEEV, Colonel, Engineer

Pages 40-43

During the past decade no equipment type has developed as rapidly and none found a road as quickly into literally all branches of industry as the electronic computer. Five or seven years ago, it was still chiefly used in the sphere of scientific research, while today's industrial automation cannot be imagined without it.

The growing importance of the electronic computer is also reflected in the Program of the Communist Party of the Soviet Union, approved by the XXII session of the Party. This progress said: "Cybernetics, electronic computing, problem solving and controlling devices should be widely used in dustrial production, construction industry and transportation, scientific research, estimates of planners and design constructors, in the sphere of stock-taking and control."

The main effect of the electronic computer is not so much the economy of work in the planning and calculating departments as the better quality of planning and the increased controlling capacity.

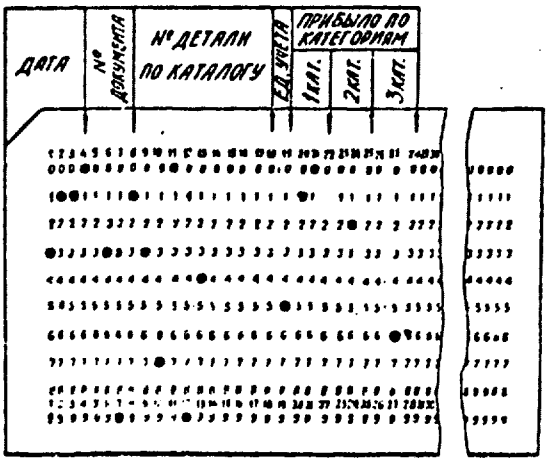


FIG. 1. Punch card for Armored Stock Taking

(Legend on top from left to right: Date; No. of document; No. of part according to catalog; unit of record; arrived, by categories: 1. Cat.; 2. Cat.; 3. Cat.)

The electronic computer finds wide employment also in military affairs, in particular for the solution of technical support problems. Owing to the change in existing forms and the elaboration of new forms and methods of work, modern conditions urgently demand an increased capacity of technical support control. Therefore, all troop sections must use computing equipment together with means of high-speed communication.

For the control of technical support, numeral machines or, as they are also called, machines of discrete, i.e., intermittent action can be used. This type of machine includes: keyboard instruments, perforation machines, and high-speed machines.

Depending upon the work performed, the keyboard machines can be divided

into adding machines, computers, and accounting(counting and typewriting) machines. The adding machines do addition and subtraction, and they record the resulting numbers on paper; they write totals and a few conventional signs. The computers make such additional operations as multiplication, division, and raising to power, without writing down the results on paper. Such machines include the arithmometers of manual or electrical drive, the semiautomats and the automats.

The accounting machines (invoice machines, bookkeeping machines) replace the adders, computers and typewriters. This machine is chiefly meant f for the composition of documents in which, together with text writing, calculations must be also made. It writes numbers, and counts them horizontally and vertically, and it prints a text. This machine makes comparatively complex operations easy. It is used, for instance, for copying order details.

All keyboard instruments have, however, their shortcomings. They are still slow in computing. Data selection is not mechanized, and in addition, such machines cannot be connected to communication channels. As an example, in workingon adding machines, the operator will spend 50% to 60% of his time on composition of numbers, and only 20%-30% of his time is work of the machine. The keyboard machines merely make human work easier in technical support control. The area of problems which they can solve is limited.

For the composition of a technical support plan, for the bookkeeping of armored and tractor stock, the VMM-2 type keyboard machine can be used.

Accounting puncher machines(SPM) are more efficient than keyboard machines. With these machines, the labor of computation is by far less. They are used in sets consisting of three perforators, two checkers, a sorter and a tabulator.

With the aid of accounting machines, it is possible to keep track of the equipment repair fund, of the armored and tractor stock as well as to compile plans for supplies and repairs. For its operation, we give the example of solving a stock taking task.

In conformity with the contents of the primary document, be it an order or an invoice, with the aid of a perforator, the operator produces holes in a punch card (Fig.1). To each line of the document, one line may correspond on the punch card. Thus, a few hundred, and perhaps a few thousand punch cards accumulate.

Each card that passed the perforator is sent to a second machine of the accounting punching machine set. It is the checker. There, the accuracy of card punching is verified. Incorrectly perforated punch cards are returned to the perforator where a new card is punched.

Before processing the numbers recorded on the cards, the punch cards are grouped, i.e., sorted out according to certain marks. For instance, first by machine brands, then by groups, groups---for every part. The symbol by which cards are sorted is the part's number in the Catalog.

It is easy to imagine how tedious and cumbersome this work is when done by hand. In the set, a machine sorts the cards. According to a general mark, it deals the cards into 12 pockets. The S80-5 sorter machine can sort out 24,000 cards by a one-digit mark in an hour. A person has merely to put them back in a receiving device.

The sorted punch cards are automatically processed in the tabulator which is tuned for work according to a program set up in advance.

Even in the accounting punching machine (SPM), however, calculation is not fully automated. Moreover, copies of the primary document, the punch cards are needed to work with. The effect of using punching machines is

thereby lessened. When SPM-s are used for inventory work and for recording repair funds, for these works the work capacity is reduced only by 10 to 15% in comparison with manual processing. If SPM-s are then used in all unit sections, the solution of the same tasks requires 5 to 7 times less work. Moreover, the calculation data of one section, for instance of a unit, will go to a higher unit in punched form, and so on. Hand punching and hand control is almost entirely excluded. Naturally, the problem-solving time is also considerably shortened. Such a complex use of the SPM is possible if a totalizing puncher will be wedged to the tabulator of each machine. According to the calculated data this will produce a totalizing punch card.

More promising devices are the high-speed numeral computers. In these computers, calculating itself goes on without any human participation. Thus, extremely complicated problems can be very quickly solved. For instance, with their help the forces can keep an inventory of the stock and repair fund, supply and repair plans can be compiled, order details can be copied, different memoranda can be composed on the technical condition of machines, and so on. Of course, for these purposes electronic machines will be used, together with high-speed communication channels, and with means for a moderate mechanization of the computing work, i.e., the computer will be a component of the high-speed controlling system.

As an example the "BISMAC" system can be cited. With the aid of this system, the US Army keeps account of supplying the forces with spare parts which come up to 250,000 separate names. The message which is fed to the system contains information on the availability of parts at the different warehouses, on transports, on obtaining production, on the required stock levels, and so on.

Naturally, every day up to 65,000 different documents are processed in this system. They contain about 1,500,000 messages. Each of them has up to 300 - 1500 marks which refer to a single part.

In difference from the accounting punching machines in which only the process of accounting itself is mechanized, in the "BISMAC" system all work is mechanized, including also preparatory work, analysis and sorting of the data.

During the past year, military specialists of many countries conducted experiments for the automation of troops control. Thus, beginning from 1954, intensive work was conducted in the U.S.A. for the creation of an automated system of troops control on the battle field (the BBS system). The main function of this system is to rapidly and continuously inform the commander on the position and operations of his forces and of the enemy forces, on the character of the terrain where combat operations are deployed, and so on.

Such system can be used also in the technical support of the forces. As an example let us consider a variant of this electronic system (Fig.2).

Its center can be the station where the SOD data are processed. It is located at the command post or the service-area control post. It should be connected with the information centers (ITS) which are in the units, while these centers in turn are connected with the technical means of intelligence:---transmitters, television chambers, infrared devices, and so on.

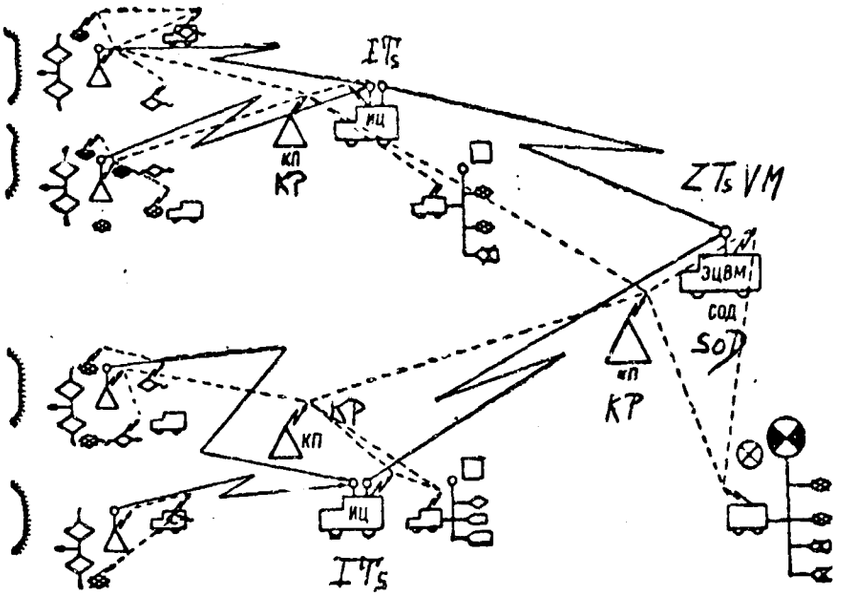


FIG.2.Example of a variant diagram for the control of technical support

(Abbreviations on the diagram: KP...command post; ITS...Information Centers; ZTsVM...Depot center
SOD....

The operating principle of the installations for initial information depends upon the nature of informations as well as upon the circumstances where these installations are located, whether in combat units or service units, for instance, whether on tanks or in repair subdivisions. The data can be visual or verbal. Visual data are transmitted by television, verbal data by radio, with the aid of letter-printing or other apparatuses.

The data obtained from the installations of original information, for instance, about some damaged machines which became unserviceable, or about the expenditure of armored stock, are processed in the information center separately by each brand of machine or by each property nomenclature.

The summarized (total) data are automatically transmitted along high-speed channels to the data-processing station. There, they are either automatically distributed to be used in the control, or they are transferred to a higher unit.

The cited control system can be used not only for controlling the technical support means during military operations, but also for planning the technical support of troops before an impending operation. With the aid of this system, when the solution is elaborated, data are also gathered about the area of military operations, its radiation status, its climatic conditions, the possibility of placement and movement of repair means over this terrain. Moreover, the different data are systematically arranged, repeatedly sorted, and evaluated. As we see, this system makes it possible to determine, for instance, standards of supply with armored stock, as well as to "rehearse" different variants for the technical support of troops still before the beginning of military operations and to select variants which are the best in view of technical support organization.

All work is done by equipment, mostly by computers, following a program established in advance, with hardly a human intervention. Thus, man got rid of the cumbersome calculations and office work. His efforts can be fully concentrated on the solution of practical organizational problems in technical support.

CALCULATION CAN BE QUICKENED

By: GAZIN D., and KOZLOVA V., Engineers
Pages 43-45

Lately, the VMP-2 mulyikey semi-automatic calculators (See Figure) are more and more widely used for calculating work. These machines differ from the VMM-2 calculator (See Technology and Armament, No.2, 1963). They do not have auxiliary multiplier keyboards, and therefore they cannot be used for automatic multiplication. But, for this shortcoming we can compensate to a certain extent, if we are usung efficiently the possibilities of our machine. Every worker assigned to this machine should therefore master all methods which can save time in calculation. Here are a few methods.

Suppose that the two numbers to be multiplied are 295 and 1789. In this case it is best to enter as multiplicand on the digital keyboard that of the two numbers whose digits, when added together, give the larger sum (in our example 1789; its digits total 1-7-8-9-25). Then, the multiplier, i.e., 295 whose digits add up to 2-9-5-16, is entered in the multiplier register (= turn indicator, in Russian) at multiplication. In this case, the machine makes nine turns less than according to the work sequence told by the Instruction. Moreover, the carriage has to be shifted to the right only twice, and not three times. The same calculation can be made even quicker. Set the number 1789 on the digital keyboard and, by shifting the carriage to the third position, multiply it by 300 (result:- 536700). Then, shift the carriage back to first position, and multiply the same number by 5 (result: 8945), and then press the subtract key. From the product 536700 the machine subtracts the product 8945, and having made only eight turns, it shows the product 527755.

During work, combined calculations of the type:

$$a.b - c.d - e.f = k$$

are often necessary.

When an inexperienced computer is working on the VMP-2, in the beginning he will multiply the number pairs one by one, jot down the results, and only then will he start their algebraic addition. The operation can be made much quicker, and above all without listing the intermediary results. First, set the first factor (number "a") on the keyboard, and multiply in the way as we suggested above in this article. Then, by pressing the multiplier register clearance key, clear the register from the multiplier (number "b") as well as from the number "a" on the digital keyboard. Thereby, the machine is prepared to multiply the second number--pair, and simultaneously to add the products together. Now, set the number "c" on the digital keyboard, and multiply it by "d". In the multiplier register the factor "d" will appear, while in the product register the sum of the products ab-cd will show up.

The product "ef" is subtracted from the magnitude "ab-cd" in the following way. Set the number "e" on the digital keyboard. Then, push the lever switch of the multiplier register to the "-" top position. This is necessary for getting the factor "f" into the multiplier register. If the given operation is not carried out, we do not get the number "f" in the multiplier register, but a number with supplements the unity. After the indicated operation, multiply the number "e" by the number "f", pressing the subtract key. At this, the product "ef" will be subtracted from the sum "ab-cd", and in the multiplier register the number "f" appears for control.

It should be mentioned that with a little practice the calculating person will carry out the discussed operations rapidly. These operations

do not divert his attention entirely from the essence of the task to be accomplished.

During calculation sometimes two numbers are to be multiplied by the same factor. In this case, it is best to set both multiplicands simultaneously on the digital keyboard. Set the larger order of the first multiplicand in the 9thcolumn of the keyboard, while the smaller order of the second multiplicand in the first column of the keyboard. After securing the entered numbers with the repeat key, multiply in the usual sequence. It should be kept in mind however that the products can"merge" into a single product register. It is therefore best to do this operation only with numbers which have not more than three digits, i.e., numbers not exceeding 999.

We discussed the peculiarities of doing multiplication on the VMP-2 machine. The other arithmetic operations are carried out practically in the same way on both this machine and the VMM-2 automat.

If a large volume of calculating work is to be done, and the suggested tricks are practiced mainly in multiplication, the time spent on calculating will be shortened by 20%-30%.

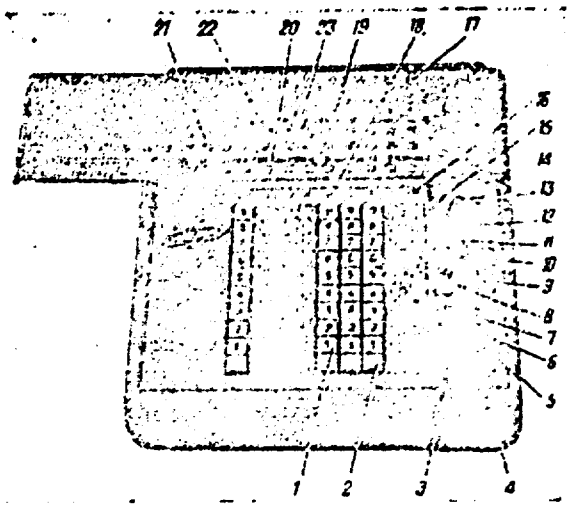


Figure (on p.44) The VMP-2 Calculating Machine

1...digital keyboard; 2...zero key, also position clearance key for setting register; 3...subtract key; 4...add key; 5...automatic divide key; 6...left shift key for carriage; 7...right shift key for carriage; 8... setting register clearance key; 9...product register clearance key; 10... multiplier register clearance key; 11...automatic divide stop key; 12... repeat key; 13...switch off for repeat mechanism; 14...carriage; 15... multiplier register shift lever; 16...control dials for number setting; 17...column (position) indicator; 18...19...23...travelling markers of decimal points; 20...product register; 21...turn knobs of product register for manual setting of numerical value; 22...multiplier register.

FIELD REPAIRS WITH RESINS

(111.)

By: B.BELOV, Lt.Colonel, Engineer

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If we have a small kit of wpoxy resins (See Figure), under field conditions we can close cracks and dents on parts, close airtight welded seams, restore joined surfaces of parts, apply anticorrosive coatings, mount repair bushings and threadless screws, repair electric wire insulation, and do a number of other works.

Epoxy Compound No. 1 (See Table) is used for repair of steel and cast iron parts, No.2 is used for restoration of aluminum alloy parts, and No.3 is used for gluing together parts of different materials (The technological procedure of part restoration and the safety engineering rules are given in the magazine "Technology and Armament" No.2, of last year).

The repair kit which we recommend is used with satisfaction in the mobile workshops. It greatly facilitates repair under field conditions.

TABLE

COMPONENTS	Compounds in weight units		
	No.1	No.2	NO.3
Resin ED-6 or E 40-100	100	100	100
Dibutyphthalate	20	20	20
Iron filings	100	-	-
Portland cement-400	-	100	-
Aluminum powder	-	5	-
Marshalite (quartz powder)	-	-	30

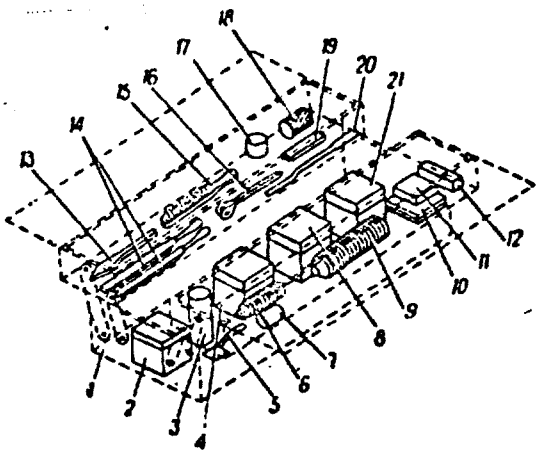

Fig.(on p.45) FIELD KIT OF EPOXY COMPOUNDS

1... Case; 2,3,4,8,21...container for acetone, hardener and epoxy compounds No.1, No.2, No.3; 5 and 7...measuring glasses; 6...binding wire; 9...paper cups for tape; 13...cape chisel; 14...files; 15...metal brush; 16...scissors; 17...porcelain crucible; 18...emery cloth; 19 and 20... rubber and metal spatulas.

TRANSPORTATION OF ENGINEER CONSTRUCTION MACHINES

By: FURMAN A., Major

(P.46-49).

Engineer construction equipment of large overall dimensions must be not infrequently transported by railroad. To entrain them by a deadline, the personnel must well know the sequence of preparation and transportation, and the rules of getting the machines on flatcars, their placement and fastening.

Since loading, placement and fastening depend upon the weight, overall size and design of the engineer equipment, we explain below the peculiar features found in the transportation of such equipment.

The D-357-G AUTOMOTIVE SCRAPER is a semi-trailer equipment whose front axle is formed by the driving axle assembly of an MAZ-529-V uniaxial tractor. This equipment has long base, wide track, wheels of wide diameter, highly placed center of gravity. Together with the tractor, the scraper weighs 18.9 tons. All the structural peculiarities must be taken into consideration at transportation.

Before loading the D-357-G scraper, the driver inspects the equipment from a technical point of view, and makes the required maintenance service. Machines whose brakes are in bad repair, or which have unadjusted controls or whose tire pressure is below the normal (3.25 atm), are not allowed for railway transportation. Scrapers of this brand are transported only on four-axle flatcars. (Fig. 1).

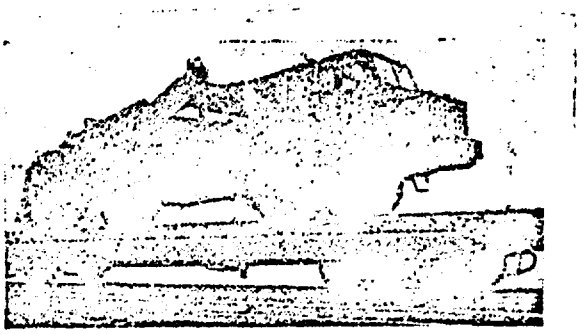

FIG.1. The D-357-G Scraper on flatcar

The track width of the MAZ-529-V tractor is 2370 mm, while the flatcar is 2770 mm wide. Therefore, even a small inaccuracy in setting the equipment may bring about that the scraper overturns with the flatcar. To aid the officer supervising the loading it is therefore best to appoint an observer who will watch that during loading the equipment's rear wheels do not run off from the flatcar. If this danger threatens, the observer reports it without delay to the loading supervisor.

With a loading device the scraper is slowly moved to the rolling stock and from flatcar to flatcar (at an even low speed), smoothly and without jumps. The gaps between flatcars are bridged over by typical crossing bridges. Such improvised means as metal sheets of less tham 5 mm thickness and airdrome plates should not be used by any means for these purposes. They do not guarantee loading safety.

The scraper is loaded from an end-loading ramp or approach ramp. The driver must place the scraper correctly alongside the train of flatcars, keeping the equipment symmetrical to the longitudinal axis of the rolling stock.

Loading from a side-loading platform or approach ramp is more complicated. For the getting on and turn of a scraper of long base (6230 mm), two

four-axle flatcars are needed:--one is for getting on, while the other is for the alignment and setting of the equipment. On single flatcars, loading from a side approach ramp is possible only if there is a tractor or bulldozer. After getting the tractor on, with the aid of such machines the rear-axle assembly of the scraper is pushed sideways onto the flatcar. This peculiarity of loading is to be taken in account, and a tractor-pusher should be loaded after the scraper.

During loading (unloading) it is not good to move the scraper along the railroad stock through many flatcars, especially two-axle cars.

While setting the equipment on the flatcar, special attention is to be paid to it that the longitudinal axes of the scraper and flatcar fall in a single vertical plane.

Against longitudinal and transverse displacements and against tilting, the scraper is tied down to the flatcar in this manner. The wheels of the tractor and semitrailer are wedged up from both sides with supporting beams of 275 x 20 x 20 cm^3 size which are placed across the flatcar. Each supporting beam is nailed with six clamps to the flatcar floor. From the inner side of each wheel, close to the tires, side beams of 60 x 15 x 15 cm^3 size are nailed with four nails. To prevent the scraper from a sidewise inclination if the air pressure would drop in one of the tires, under the axle of the equipment supporting crates are placed from beams. The lower crate beam is put along the flatcar upon the supporting beam wedged under the wheel. All crate beams are fastened together with clamps. Moreover, the equipment is tied with eight wire (cable) bracings. Four of these are for the tractor, and four for the semitrailer's axle. Each bracing is of six soft-wire filaments of 6 mm diameter. To increase the equipment's stability on the flatcar, the tractor's hand brake is pulled tight, and it is put in low gear.

According to experience, a team of 5-6 persons will fasten a scraper in 35-45 minutes provided that the materials are ready in advance and the beams are fitted at the site for the installation of crates in advance. It is therefore advisable in all cases to assign 4-5 persons for aiding the driver of the scraper.

Other automotive scrapers weighing more than 16 tons (the D-547 with tractor MoAZ-546, the D-392 with tractor BelAZ-531, and the earth mover D-504 of rear-end unloading on an MAZ-592-V one-axle tractor) are also loaded and fastened likewise on flatcars.

The D-350 ROAD GRADER is transported on two-axle or four-axle flatcars. Before its loading, the working outfit is raised, the blade is swung into the horizontal plane so that its angle with the equipment's longitudinal axis will be 45°. The bulldozer and the ripper, mounted on the equipment, are either brought into transportation position, or they are disassembled and transported.

During loading and unloading, the road grader's manoeuverability at turns is increased by setting its front wheels loose ("wobbling-Russ."vrazval").

On the rolling stock the road grader is placed so that its longitudinal axis and the flatcar's longitudinal axis are situated in the same vertical plane. After setting the road grader on the flatcar, its hand brake is pulled tight, and the gear lever is shifted into first speed.

The road grader weighs 17.5 tons. It is fastened in the following manner. The front- and rear-axle wheels are wedged up from both sides with supporting beams of 275 x 15 x 15 cm^3 size. Each beam is nailed with six clamps to the flatcar floor. From the inner side of the equipment's wheels, lateral beams are placed. Their cross section is 15 x 15 cm^2, and they are 50-60 cm long. They are nailed with four nails. Additionally, the grader is fastened with eight wire bracings:--the front axle with four (two from the front, and two from the central axle's side), the central axle with two (from the front axle's side), and the rear axle also with two (from the

rear-end side of the flatcar).

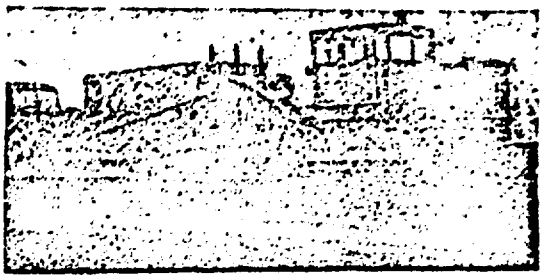

FIG.2. The D-326 Roller with a S-100 Tractor

In the new brands of bulldozers, the working outfit sometimes exceeds by its overall dimensions the standards established for railroad transportation. In such cases, the outfit is disassembled before loading, and transported separately. For instance, the D-259-A (length of blade 4150mm), and the D-493 (3940 mm) bulldozers are transported without blades.

The removed working outfit is placed on the flatcar floor under the equipment, and is fastened with additional wire bracings.

The D-259-A BULLDOZER (Base S-80) and the D-493 Universal BULLDOZER (Base S-100-GP) are transported singly on two-axle and in pairs on four-axle flatcars. Before loading, the bulldozer's blade is removed, and the carrier body is raised to the utmost top position. This permits that, after loading is finished, all sides of the flatcar can be closed. If the lifting mechanism of the body or the oil gear is somehow defective, and cannot hold the body raised during loading, then, after loading the tractor on the flatcar, the carrier body is lowered, and the flatcar's sides between which the carrier body is located are fastened in a dropped position. Since the blade will be taken off, the tractor is set on the flatcar according to general rules. It should be mentioned that the blade's disassembly from the carrier body requires considerable time, and it must be done well in advance before the subunit arrives at the loading site.

The tractor with the carrier body is fastened to the flatcar with supporting beams and wire bracings, and by the wireless method (using supporting and side beams) according to general regulations. The removed blade and the additional outfit of the bulldozer are placed in the flatcar floor under the tractor between the caterpillars, and reliably fastened with wire bracings.

The D-515 ripper can be also combined with the D-493 bulldozer. It can be set behind the tractor. When this combined aggregate is loaded, the ripper's ploughs are raised to the utmost top position so that they do not touch crossing gangways and the rolling stock. After setting the equipment on the flatcar, the ripper's ploughs are lowered on a pad formed from a 40-50 mm wooden board which is nailed to the flatcar floor.

The tractor with the ripper is fastened with four wire brackets and four supporting beams to the flatcar. Each beam is nailed with two nails to the flatcar floor. The wireless method of fastening is not used in this case.

Heavy sectional trailer rollers on pneumatic tires are usually transported coupled with regular tractors. Before loading, the ballast is emptied from the roller's body.

The D-326 FIVE-SECTION TRAILER ROLLER ON PNEUMATIC TIRES with tractor-- an S-100 (Or S-140) tractor-- is transported on a four-axle flatcar(Fig.2). Since the roller's width considerably exceeds the overall dimensions permissible for railroads, the two extreme (lateral) sections with the wheels are disassembled.

The roller is loaded on flatcar, while being towed by a tractor. When the roller is moved along the rolling stock, the gaps between flatcars are bridged over not by the usual two, but by three crossing bridges placed in a single row.

The coupling, consisting of tractor and roller, is placed on the flatcar symmetrically with their longitudinal and transverse axes. It is not recommended to uncouple the tractor from the roller. Coupled with the tractor, the pneumoroller is more stable.

All wheels of the trailer roller are wedged up from both sides with supporting beams nailed to the flatcar floor. From the external side of the lateral wheels close to the tires, side beams are nailed. The roller is tied with four wire bracings. The tractor is fastened with supporting beams, and wire bracings.

The disassembled lateral sections with the wheels and the heavier parts of their fastening are placed on the flatcar, or in bodies of empty automobiles. On the flatcar the section is placed flat, with the wheel toward one of the lateral sides of the flatcar. On each side of the wheel, supporting beams are nailed, and the flatcar's lateral side is externally strengthened with four to six short posts.

Together with the large overall-size equipment, freight trucks and dump trucks are also transported on the railroad. This makes possible to use a wide combination in loading:--automobiles can be placed over the coupling of the flatcars which are loaded with wheeled or caterpillar-driven engineer construction equipment.

DETERMINATION OF WOOD STRENGTH

By: LYUBCHENKO N., Captain and
FILIMONOV, N., Lt.Colonel, Reserve

p.48-49

The strength of wood which is used in construction of different buildings is usually determined by laboratory methods (GOST 6336 - 52) which are almost inapplicable under field conditions. In the practical life, accelerated methods are used for testing wood strength:--the depth of bullet penetration, or the percentual bullet content of wood.

For the Armed Forces, the bullet-firing method is of greatest interest. It can be used when standing timber and supply lumber is selected and when the condition of wooden parts is tested in buildings, bridges and other structures. Wood strength is determined by the depth of the bullet hole which the projectile of a small-caliber TOZ-8 or TOZ-9 rifle makes radially to the annual tree rings.

A Makarov pistol can be also used for the same purpose. As our experiments showed, pistol bullets penetrate wood 1.4 times deeper than bullets of a TOZ-9 small-caliber rifle. It was also established that as an average the tentative resistance of wood (pine trees and spruce) is 1.75 times greater to transverse bending than to compression in a longitudinal direction of the fibers.

According to these data, we have also compiled a table which makes possible to determine from the bullet's penetration the tentative resistance of pine, and spruce with a 15% moisture content to compression and bending.

For freshly felled timber with 30 or more percent moisture content, or for standing timber, the data which are quoted in the Table must be reduced:--1.7 times in case of compression work, and 1.4 times for bending work.

Bullet penetration in millimeters		Tentative resistance of wood(pine, spruce) in kg/cm^2	
TOZ-9 small-caliber rifle	Makarov pistol	to compression along fibers	to bending
40	56	440	770
50	70	390	680
60	84	355	620
70	98	350	580
80	112	315	550
90	126	300	525
100	140	290	510

The wood strength of pine and spruce is tested in the following way with the bullet-firing method. From the batch of timber, 3-4 specimens not shorter than one meter are selected. The diameter (thickness) is 15 cm or above. At 10 cm distances, each specimen is shot at with a Makarov pistol 3-4 times so that bullets will be distributed along the wood radially to the annual tree rings. Then, with a steel thickness tester, with 2-2.5 cm diameter the depths of bullet penetrations are measured. These values are averaged, and the critical compressive strength and transverse bending strength of the wood is determined from the Table.

Take a concrete example. Suppose the strength of a lot of freshly felled timber has to be determined. With a Makarov pistol, the average depth of bullet penetrations was 111 mm. Then (See Table) the range of wood strength is 316 kg/cm^2 at compression work, and 553 kg/cm^2 at bending work. But the tested wood contains more than 15% humidity. Consequently: 316 : 1.7= 186 kg/cm^2, and 553 : 1.4 = 395 kg/cm^2.

In checking the wood condition of a bridge if the bullet of a Makarov pistol penetrates, for instance, to 125 mm, then, according to the Table, the critical resistance of wood will be about 300 kg/cm^2 to compression in the direction of its fibers, and 525 kg/cm^2 to transverse bending (at 15% moisture content). Consequently, the bridge has preserved 85% (300/355 x 100%) of its original (designed) load-carrying capacity (355 kg/cm^2 is the critical resistance to compression of freshly felled timber).

Thus, the bullet-firing method of wood strength determination can be used in conducting engineer reconnaissance of local construction materials and in determining the timber condition in wooden structures.

OPERATION, SAVINGS, REPAIRS

BEFORE THE SUMMER OPERATIONS.

By: KOLESNIKOV,A., Colonel, Engineer, and
RYMARENKO,A. , Colonel, Engineer

P.50 - 53

Skillful spring-summer operation of armored equipment depends largely upon how well the personnel, and of course the equipment itself, is prepared for it. For the personnel, assemblies are usually formed where the soldiers acquaint themselves with the peculiar features of spring-summer operation, with the volume and technique of the works to be accomplished on the material. On the example of one of the units let us show the best method of making such arrangements.

The preparation for summer operations started there with calling together a three-day assembly for technical service officers, including also those who specialize in tank armament, signal communication facilities and Class III supplies. The commanders themselves wanted to participate.

On the first day the commander made a summary of the winter operations, and outlined the problem of converting the equipment to spring-summer operations. Then, his technical deputy explained what features were peculiar in the summer operation of armored equipment. All problems were thoroughly studied, and the set requirements were theoretically explained, since many participants themselves expected to conduct future classworks with their subordinates.

On the second assembly day, group exercises were held (for tank groups and motor car groups) on the training grounds. Under the guidance of excellent specialists, the assembly participants got acquainted with summer operation materials, with the volume and technique of work. Independently they set up defects on vehicles, and determined the technical condition of such vehicles with special instruments.

On the other training grounds, they studied the Motor Tractor Section equipment and the new park equipment expected to be forthcoming for supplies. The assembly participants got acquainted with model sectors for doing the most important operations in changing the vehicles to spring-summer usage.

On the last day, lectures were read on new equipment, and the assembly participants passed an examination.

In the units, one-day assemblies were formed, for platoon, company and battalion commanders. Special attention was paid to the methods of trouble shooting and removal of faults directly on the materiel, and to after-operation checkups on accomplished works.

For the crews two-day assemblies were arranged. The participants of such assemblies learned how to do all works independently in changing the materiel to summer operations. They also learned the peculiarities in using and servicing vehicles in this season. They got also acquainted with the rules of using the park equipment. Special attention was paid to safety measures in work. At the end of the assemblies, all participants had to pass an examination. The results of this and the names of crew members admitted to spring-summer operation were included in an order.

As proved by experience, the vehicle maintenance servicing best starts with inspection of the vehicles by technical deputy commanders, platoon commanders and by the crew. All data are entered in a special report. Clarity of purpose in the crew's work depends upon the degree of thoroughness in checking the vehicles.

Many units are too enthusiastic today about the creation of specialized teams for the different operations of tank maintenance. In our opinion, together with a few advantages, this method also has a great shortcoming:---it diminishes the crew's responsibility for the quality of work done, which also reflects somehow upon the competitive movement for gaining the title of "best crew in the unit". Moreover, it does not promote the formation of practical habits in the personnel's mastering of complex equipment. Experience shows that ---with adequate preparation, aid and control by technical service officers and unit commanders---all tank works can be performed by the crew itself both adequately and by the set dates. If at the conversion of wheeled motor vehicles to seasonal operations their crews are not at full strength, in our opinion the use of the team method or the assembly line method is the best.

In maintenance servicing, a thorough after-operational checkup is necessary to verify the course and quality of works accomplished. We shall show on a concrete example how important this requirement is.

In one of the units (podrazdelenie), when a tank was taken out from short-time storage, the tank driver discovered that at the mode of operation the oil pressure was always 5 kg/cm^2, but the motor vehicle had not worked even for half of its timw between repairs yet. Since there was enough oil in the oil tank, he suddenly thought that something might be wrong with the oil filters. It turned out that in the oil tank the coarse filter, which was exceedingly difficult to reach, was very much comtaminated. They forgot to wash this filter when the vehicle was in storage. Undoubtedly, if every single operation would be checked, this would not have occurred. After washing the filter, the pressure in the system at once returned to normal.

For different vehicles, even though they are of the same brand, the work volume can greatly differ in converting the vehicles to summer operation. All depends upon which group the vehicle belongs to. The most typical and most widely spread variant is the preparation of vehicles in operation.

Depending upon actual conditions, such vehicles are serviced in the work schedule of the No.2 and No.3 technical maintenance. In addition, work is made on them without which it would be wrong to operate the vehicles in summer. Thus, in the feeding system the winter type Diesel fuel is replaced with summer fuel. In individual cases (which are specially stipulated) the winter Diesel fuel may be used up (but this does not mean the Arctic Diesel fuel). On vehicles whose fuel pump drive can be regulated the spindle coupling must be moved to the "summer" position. This is not just a formality in the Instructions, but a provision that prevents reduction of engine power and excessive fuel consumption. Moreover, the oil coolers are switched on, on the component parts of weapons the lubricant is changed, and the storage batteries are serviced.

The air-capor valves are especially thoroughly regulated because otherwise engine overheating can develop after 3-5 hours of movement. It also overheats if the radiator surfaces are not cleansed.

The low-freezing coolant is drained out from the engine's cooling system into a special container and water with three-component admixture is poured in its place. If during the preceding period of operation sometimes the engine worked at an increased thermal regime (above 90°C), the system is washed out.

Related documents stipulate that the preheater is to be disconnected, but operating experience and special investigations prove that it is best to disconnect the preheaters at -12-15 degrees of external air temperature. Thus, motor transportation potentials are saved on engine warm-up, and the engine's wear and tear in the starting period is diminished.

At their conversion to spring-summer operations, engines in short-time storage are subjected to partial removal of leakproof packing. This is

usually done at the time of the technical maintenance or when the vehicles are taken out from short-time storage. In both cases, in addition to the works already discussed, the following is done.

Tarpaulins are taken off and stowed away on site. From unpainted surfaces of aggregates and parts of the vehicles, the lubricant is removed. This is a proper place to mention that leakproof gauze, putty and silica-gel bags should be preserved for future use. Unfortunately, quite a few soldiers forget to save these expensive materials.

Furthermore, plugs are pulled out from the outlet pipes, the cooling system is serviced, taken-down equipment is adjusted, and the tightness of the air filter's joint with the engine's suction manifold must be checked. On vehicles with carbureting engines it is checked whether there is enough oil in the air filter; the wire packing is oiled, and special attention is paid to correct re-assembly. In engines of all systems the condition of pipelines and durite joints and the existence of leakages is checked.

On wheeled vehicles the tire pressure is checked. The ventilator, generator and compressor drive belts are tightened, while on caterpillar-driven vehicles the running gear is inspected, and the caterpillar bands are tightened (as the operating conditions may require). It should be remarked that too much tightened caterpillar bands will wear out 30% to 40% quicker than those of normal setting.

During storage, cases may occur when oil leaks out partly from the oil tank into the crankcase. Therefore, before the tank is refilled with oil, the amount of oil in the crankcase must be verified. Oil is reverted into the oil tank by one of two methods:--either the crankshaft is twisted with the starter, or the oil is drained from the crankcase and poured back into the oil tank. Oil is always best refilled with the aid of a fuel pump having an appropriate filter. If the oil is hot, then not much effort and time is wasted on it.

When wheeled vehicles, especially armored carriers are prepared, in addition to the usual No.2 and No.3 technical maintenances, a number of either works are also done. Thus, not only the winter-type fuel and lubricant is charged in the systems, but the crankcase, gasoline tanks and pipelines are also washed out. If this is done, the carburetor jets will not become obstructed.

The carburetor is taken off, and the fuel level and leakproof sealing of the needle valve in the float chamber is checked (TABLE 1). It reads normal if the water-level pressure does not exceed 25 mm at triple checking in 60

TABLE 1. FUEL LEVEL IN THE FLOAT CHAMBER

Brand of carburetor	Fuel level in mm
K-49D	15-17
K-84	18-19
K-84M	18-19

seconds. Its capacity of passing is determined by the water amount which passes through the jet under 1000 - 2 mm water pressure in 60 seconds at 20 - 1°C temperature (TABLE 2). The fuel pump is also checked. If it is in good repair, a jet of gasoline will appear after 10-12 pumpings. The maximum pressure should be 0.4 - 0.5 kg/cm^2. The tightness of valve fittings is judged by the speed of pressure drop. If a pump is in good condition, the pressure will not drop more than 0.1 kg/cm^2 in 30 seconds.

Before checking the cylinder compressions, the engine is warmed up until the coolant's temperature reaches 60-70°C. The ignition plugs are unscrewed from the cylinders, and the air and throttle valves are fully opened.

Compression is measured with fully loaded storage batteries. It should correspond to the data given in TABLE 3, and the difference between cylinder compressions should not be more than 1 kg/cm^2.

TABLE 2. PASSING CAPACITY OF JETS, cm^3/min

Name of jet	Carburetor brand	
	K-49D	K-84
Main	350-8	300-4
Compensating	-	-
Supplementary	350-8	-
Economizer's	150-10	110-1.5
Fuel jet at idle running	53-3	0.6-0.06
Air jet at idle running	225-10	-
Atomizer's jet	-	350-4.5

TABLE 3. TECHNICAL DATA FOR ENGINE CHECKING

Brand of engine	Compression ratio	Normal compression pressure kg/cm^2	Nominal permissible compression pressure kg.cm^2
GAZ-40	6.2	6.5 - 7.5	5.5
GAZ-40 P	6.7	7.5 - 8.5	6.0
ZIL-123 V	6.5	7.0 - 8.0	6.0

In the lubrication system of armored carriers, the good condition of oil coolers, oil lines, pump and control devices must be checked. The radiator is included. From the walls of the cooling jacket of the cooling system boiler the scale is removed, the chamber and the exhaust outlet are cleaned from carbon deposit. Thereafter, the preheater is taken out, dead-storaged and sent to the depot.

REPLACEMENT OF CONTROL BRACKETS

By: FEDULOV N., Lt.Colonel, Engineer

p.53

By means of a simple device, any intermediate support of a permanent overhead communication line can be refitted into control support. In this device, the control supporting brackets or straps are replaced with two strain ("egg") insulators joined together with steel wire. The insulators are 85 mm long, and 60 mm thick. The steel wire is 85-90 cm long, and its diameter is 4 mm. The ends of this wire are fixed with a terminal tie (See Fig.)

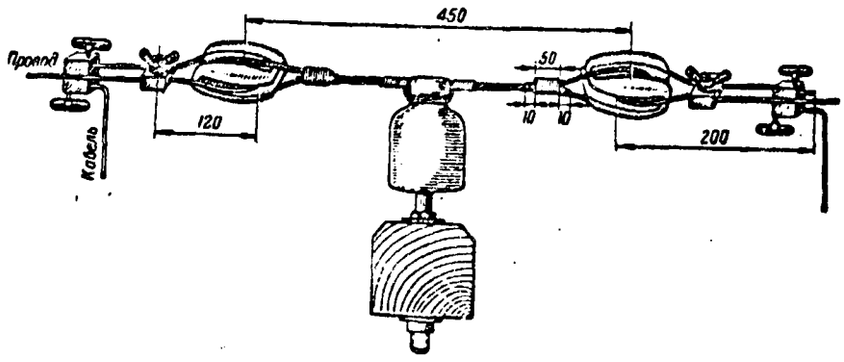

Fig. Outfitting a control support with strain insulators joined with steel wire
(On left side, horizontally: Line wire; Vertically: Cable).

The strain insulators are mounted on the support in this manner. First, the line wire is clamped in block lugs and liberated from its tie on the insulator. Then, it is cut with pliers. To the cut ends of the line wire, revision pressure connectors of appropriate diameter are attached, and they are moved 40-50 cm forward. The line wire is bent around the strain insulators, inserted into the free apertures of the connectors and fastened with screws.

Then, the block lugs are taken off from the line wire. The steel wire is fastened to the insulator with an intermediate tie. The control slit is ready. To the cut ends of the line wire, a second set of revision pressure connectors is attached. They are for joining the permanent line wire with field cable lines (the ends of the field line wires are inserted in the pressure connector openings, and compressed with screws).

To reconnect the permanent line wires again directly, they are fastened in blocks. The steel wire tie is removed. The screws of the pressure connectors are relaxed. The line wires are removed from the strain insulators.

If the line wires are of steel, they are compressed in welding pliers, welded together with the aid of thermite cartridge muffles, and fastened on the insulators with intermediate ties. If they are of non-ferrous metals, they are connected with copper tubes with the aid of a screw plate and a wrench.

The device for control support outfitting was many times used under field conditions, and proved to be useful. It was prepared by Sergeant S.Mokryakov.

TIMELY PREPARATION OF RADIOELECTRONIC EQUIPMENT.

By: SHUTENKO M., Colonel, Engineer

p.54-55

In units and podrazdelenies related to radioelectronic equipment operation an important condition of reaching high-grade combat readiness is the timely preparation of equipment. This usually includes a number of protective and reparative measures:-- overhauling the mechanisms, changing to summer lubrication at the same time, checking the cable and storage-battery economy, and so on.

The work of radioelectronic equipment can reach high efficiency only if the local climatic factors and concrete conditions of storage and equipment operation are thoroughly considered. We dwell below on a few peculiar elements in the technical maintenance of radioelectronic stations and on their preparation to summer operations.

If in regions of high atmospheric humidity radar stations are kept idle for a long time in the open air under low temperatures, before they are switched in, the equipment, especially such junction points and units as high-voltage detectors, transmitters, wave guide feeder systems and power take-offs must be dried out. For this purpose, electric heating elements of desk panels and units are engaged for some time, and even the filament voltage of radio tubes is switched in. But before this is done, high-voltage insulators and parts which during working are kept under high voltage are thoroughly wiped off with clean rag moistened in alcohol.

For the operation of certain radar stations the Instructions recommended that the wave guide and feeder systems (=VFS) be periodically thoroughly disassembled for the sake of their protection. In areas of higher atmospheric humidity with sharp variations of temperature and in seashore districts, the VFS must be disassembled much more frequently than it is required in the Instructions for normal operating conditions.

In certain radar stations the wave guide feeder lines are sealed leak-proof with rubber gasket. Due to sharp temperature variation and long continued operation, the gaskets will "age". Their elasticity deteriorates, and the entire wave guide feeder line system may get out of order.

In the above indicated areas, the coating (passivation, enamel, etc) is rapidly ruined, in the wave guides. Copper oxide appears on the soldering sites of feeder line sections, and more high frequency power is lost. At inspection it is best to pay attention especially to drain holes which exist in the wave guides of certain stations, and their clogging should not be permitted. It is best to check the condition of contact surfaces at the sites of wave guide splittings, the condition of floating contacts, of the inner wave guide cavities, the condition of packing material and lubrication in the bearings of rotating wave-guide feeder joints.

After their assembly, the wave guides should not have any bends and stress, and in the elements of magnetron linkage and in all wave-guide line flanges no sparking, brushing or high-frequency power leakage should occur.

High-frequency power leakage is tested, for instance, with the aid of a neon tube which, if held against the flange, will not light up when the VFS is well assembled.

The above indicated climatic conditions will influence the function and other important parts of the radar stations:--- power takeoffs, serial column reductors, cables and cable splittings of radio sets, and so on. Therefore, more often than required in the Instructions, the electric power takeoffs are examined and subjected to cleasing with a twill strip moistened in alcohol.

For leakproof sealing if the sectional joints of reductors (lids, selsyn compartments, and so on) sometimes special water-resistant and non-drying putty is used. Under the effect of cold temperatures (in winter operations) the putty can lose its viscosity. It may scale off from the surface of reducerors. When this happens, the joint's leakproof character will be ruined. The putty's condition should be systematically watched, and, if needed, it should be replaced.

Sets of radio engineering articles sometimes happen to fail in working due to a breakdown in the cable joint contacts. If the leakproof character is ruined, moisture falling upon the cable and cable splittings can cause a marked drop in the insulation resistance, and can disturb the normal function of the set. Therefore, cables and cable splittings are regularly checked, repaired, by replacing the damaged lacking lining of splittings with new ones. When doing preventive maintenance work, the value of insulation resistance is to be measured. For conductors in the cable installation of power current circuits, synchronous transmission circuits, and control circuits the resistance should not be less than 10 Mohm, and for high-frequency cables of the RK type it should be practically infinite.

If radar stations are operating under conditions of increased sutiness and high atmospheric temperature, certain additional measures must be taken to assure a faultless operation of the equipment. First of all, it should be recalled that dry sandy ground is a bad conductor of electric current. Therefore, before stations are switched in, the feeding units must be checked as to their grounding.

When the block unit assembly is inspected at the weekly and monthly preventive maintenance work, attention is paid to the absence of any sign which would indicate scorching or overheating of the resistances and assembly plates (external sign:--darkening of painting). Scorched resistances are replaced, and plates are wiped off with alcohol. The dirt is removed from remote switches, magnetic starters, relays, electric motors and selsyns, and then they are washed and lubricated. The good function of the ventilation systems is also checked; they blow air around the magnetrons, modulator tubes and other electronic units which work with a heavy thermal regime.

Sometimes when ventilator motors are replaced with new ones, the phasing of the feeding electric network is not maintained. This causes the fan to revert into the opposite direction, and it markedly disturbs the air current blowing around the magnetrons and other parts of the station, which may be a reason that not infrequently they get out of order.

If radar stations work heavily under high environmental temperatures, then, if the building construction permits it, it is best to pull out the block units a little from the desk panels and to disconnect the trays. This will make possible to have better air circulation and thereby stronger cooling of the units, too.

Radar stations should be always ready for the execution of a march. This raises special requirements for the preventive maintenance of the running gear:---the braking and signaling system should be systematically regulated; lubricationshould be changed in good time. In hydraulic systems the fluid quality, pressure and condition of the pressure systems is checked. Checking the condition of jacks, and changing the lubrication in good time, is obligatory. The ZIP (=spare parts, instruments and devices) should not be forgotten either. It should be kept in full strength. The function of each component unit blocks should be checked. The magnetrons and other articles should be conditioned ("trained").

SPECIAL FEATURES OF DRIVING MULTI-AXLE AUTOMOBILES AND TRUCK TRAINS

By: SOLOV'EV F.,Lt.Colonel, Engineer and
PYATACHKOV,G.,Lt.Colonel, Engineer

P.56-57

Multi-axle automobiles and truck trains have a rather high degree of cross country capacity. This can be explained by the fact that their engines are of large specific capacity. Moreover, in the case of multi-axle automobiles, all axles are driving axles, and the large-diameter tires are provided with an air-pressure regulating system. On many automobiles, hydrodynamic transmissions and interlocking differentials are used (interwheel and interaxle differentials).

Although there are also concrete devices on such engines to master difficult road stretches and terrain sectors, much depends still upon the drivers' correct use of these devices. Having generalized the experience in driving multi-axle automobiles and truck trains under spring-summer conditions, we can make a few general recommendations which can be summarized approximately as follows.

When a wheel rut has been already beaten, we should move along it (in-[illegible] it). The rut ground is condensed, and thus the probability of the automobile's slippage and skidding is considerably diminished. In a wheel rut (-track) one has to move with steady speed, in a transmission selected in advance, and, to prevent the wheels from slipping, the engine revolution is kept at a steady rate, and stops are not made suddenly.

Not less important is the correct use of the tire-pressure regulating system. On automobiles provided with such a system, the drivers reduce the tire pressures ahead of time while still approaching the difficult road sector. When an automobile is already bogged down, in the majority of cases the tire-pressure reduction will not have any beneficial effect.

After the passage of a difficult sector, the engine is stopped, and the tire pressure is raised at least to 1.5 kg/cm^2. If automobiles are moving for a long time with reduced tire pressure, their service life gets shorter. The pressure can be increased to normal during movement at a speed not exceeding 30 km/h.

The mode of automobile movement is chosen according to road conditions. As a rule, on muddy dirt roads, the ZIL-131 and the URAL-375 automobiles shift to second or third gear in the transmission gearbox, and to first gear in the distribution box. Longer stretches of difficult road sectors are passed in first or second gear, with engaging the reduction gear in the distribution box, the front axle, and the block system of differentials. It should be mentioned that at forward movement the front axle of first-issue ZIL-131 automobiles becomes automatically engaged, depending upon the magnitude of the given movement.

When the automobile is backing, the front-axle engagement mechanism is blocked. This is best done for the whole time while passing through a difficult sector. Then, the front axle will be engaged both at the automobile's forward movement and at its backing.

On some motor cars of the Moscow Automobile Factory the most difficult road sectors are passed in first gear and reduction gear of the underdrive. To avoid automatic gear shift, the lever is in the "P" posotion (in all other cases the lever is in the "D" position at forward movement). At this time, the tire pressure is reduced to 1.0 - 0.8 kg/cm^2.

There are no spring suspensions in these automobiles, and therefore special driving methods are used. Thus, to prevent that, during advancing on

undulating roads, including surfaced highways also, the steerability of automobile is lost at increased speed (angular vibrations rapidly increase in this case), the driver suddenly releases the pressure on the throttle-plate pedal (=the accelerator). But if this does not help, he starts braking the engine.

In moving on a road with potholes at a speed of 10-15 km/h, the automobile begins to jump up and down. To avoid this very undesirable phenomenon, the speed of movement is increased to 20-30 km/h. If this cannot be done, over long road sectors the tire pressure is reduced to 0.8 - 0.9 kg/cm^2, and over short stretches, the speed of movement is reduced to 5 km/h.

When similar motor cars of the Moscow Automobile Factory are driven on dirt roads, the same gears are engaged as in the URAL-375 automobile. Individual difficult route sectors are passed in first or second gear of the planetary transmission, and in reduction gear of the distribution box. In this case the hydraulic torque converter is disengaged, and the tire pressure is reduced to 1.0 - 0.8 kg/cm^2.

We wish to pay special attention to certain peculiarities in driving truck trains on dirt roads. Due to the unevenness of dirt roads and the skidding on them, the trailer (semitrailer) body starts to move from side to side. To "cancel" these movements, the vehicle is speeded up briefly.

In truck trains, especially with one-wheel trailers, resonant vibrations will arise at certain speeds of movement on roads of uneven surface. The wheels get away from the road bed, and there is danger that the truck train overturns. Before arriving at uneven road sectors, the speed of movement is to be reduced, and not only the automobile tractor but also the trailer (semitrailer) must be carefully led across these sectors.

It is difficult for a trailer to get into a deep wheel rut and to get out of it. Therefore, sometimes a part of the truck train is moving in the wheel track, and another part along the wheel rut. To bypass a transport which comes from the opposite direction is very difficult for such a truck train. The driver of that part of the truck train which is moving along the wheel track will select the spot where the track depth is the shallowest, and, after going out from the passing place to the roadside, he lets the encountered transport through. It is appropriate here to mention that in all cases, on all sorts of road, braking must be smooth, and only when the truck train is moving in a straight line, otherwise a trailer with tractor will skid at braking.

When a truck train gets stuck, the difficult road sector is passed by the automobile (the tractor), and thereafter, with the aid of a winch and towing cable the trailer is drawn up to it.

COMPOSITION FOR PAINTING ALKALINE BATTERIES.

By: MOTEL' A., Major, and
GONCHARENKO, B.

p.57

Pour dichloroethane into a clean glass or enamel vessel. Then, throw in it fine pieces of foam plastic, and let it stand until complete solution. Repeat this until the composition becomes as viscous as gum Arabic.

It is not proper to prepare the composition in advance since the solvent evaporates very quickly, and the composition gets useless. Work with the composition is possible only in well ventilated rooms. From the walls of alkaline batteries clean off the old paint thoroughly, and degrease them with clean gasoline or acetone.

On the so prepared battery, with a soft brush, apply a thin layer of the composition and let it dry. Then, coat the accumulator with the usual asphalt lacquer. Upon the dried lacquer apply the foam plastic composition. As a result, a film is formed in which the lacquer is sandwiched between two layers of foam plastic. The alkaline electrolyte will not corrode such a film.

MEDIUM MAINTENANCE OF TANKS BY THE ASSEMBLY LINE METHOD

By: LISOVSKY Yu., First Lieutenant, Engineer

FOR HIGH-GRADE EFFICIENCY OF LABOR!
p. 58 - 60.

INTRODUCTION: In its program, the Communist Party of the Soviet Union sets the basic task of doubling the productivity of industrial labor in the first ten years, and of raising it to a four-four and a half times higher level in twenty years.

In the following article we discuss how, by using the production line method of repair, by progressive technology and wide use of small-scale mechanization means, one of the repair podrazdeleniya (units) could almost double labor productivity, improve the quality of repair, and raise the qualification of repair specialists.

* * *

Not so long ago we changed over to the production or assembly line method of medium maintenance for armored materiel. We started with elaborating the technological procedure. We determined the number of posts, their work program, and how many and which kind of specialists should be at each post. We compiled a list of outfit required for each post.

For the workshop personnel we conducted classes. We investigated the order of procedure for tank repair. To the teams of posts we handed out maintenance kits, technology charts indicating the program and sequence of works.

Our production line is simple, and it is divided into ten posts with a work program of 40 to 70 manhours at each of them (See Table 1).

All posts are set up directly one behind the other, except Post 9 which by the character of its operations does not depend upon others and is therefore placed somewhat apart from the main line.

The vehicle is put in repair according to the Chart, and we set up a dossier for it. This dossier accompanies the vehicle to all posts until the repair is finished. Only after the determined operations have been completed at a preceding post has the shop superintendent the right to move the vehicle from one post to the next. The Chief of the Materiel Control Section (=OTK) notes this in the vehicle's dossier.

The working production line is directed by the superintendent of the Assembling-Disassembling Department. The personnel services the line (See Table 2). At all posts, the tank drivers take part in the repair of vehicles allotted to them.

The use of production line with the same outfit and same number of personnel, made possible to almost double labor productivity. Due to the distribution of operations, the team members and the kit man immediately know what each post should have for its continuous work. As a result, no surplus parts or spare components will accumulate in the shop.

Control of the repair quality has also improved. Previously, to avoid idling, one had to proceed to the next operation, without having completed the preceding phase of work. For instance, they started to assemble aggregates, without having completely finished the installation of containers. When the Materiel Control Section discovered defects at the acceptance of work, much time was spent on their elimination since the aggregates were already installed. Thereby, further work was also delayed.

The production line method of repair helps us in getting rid of this kind of shortcoming. The team makes every effort to completely finish an

operation, and to deliver it to the controler of the Materiel Control Section. The latter accepts one operation only, whereas with the ordinary method he used to accept several operations at once. Moreover, until all discovered defects, if any, were not eliminated entirely, the team cannot start working on the next vehicle.

The assembly line method of repair makes possible to raise the qualification of repair specialists. When the ordinary method of repair is used, as a rule the repairman is a specialist of a narrow field. He is occupied only with centering the aggregates, or with some other type of operation. In general he does not carry out many possible operations, since those are best mastered by other members of the team who do them quicker and more thoroughly. As a result it happened that repairmen frequently had no idea how to do one or another particular operation.

When we changed over to the production line method, we took care that the fitters got practice in all operations. After the team members had 5 to 7 vehicles repaired, they will master all the operations of a given post, and have a clear idea about the work sequence and methods of work performance. Thereafter, all the teams were shifted to another post, and everything was repeated from the beginning. After passing through the whole production line, the fitter will perfectly master the whole work program, the work sequence and ways of work performance, and under combat conditions he will be able to do any kind of tank repair work in a qualified manner and quickly.

We should think that our experience is not unique. Many repair units changed over to the production line method at one time. It was good to learn of their work also on the pages of this journal, to exchange experiences for an easier mastery of the progressive methods of armored materiel repair. You see, the November Plenum resolution, brought by the Central Committee of the Communist Party of the Soviet Union, makes it our obligation to penetrate more profoundly into work organization, to fight still more persistently for the introduction of new progressive technological procedures.

TABLE 1. a)...Post functions
b)...List of required outfit, instruments and devices

POST No.1
a) Washing the vehicle, the equipment set, the aggregates of the repair fund.
b) Washing pump, pressure hose with nozzle, brush, scraper, punch, sledge hammer.
POST No.2
a) Stripping the vehicle, and preparation of junctions and parts for trouble shooting.
b) Stands for armore, engine, transmissions, side transmissions, rocker arms and torsions; rack for parts; basket for standards; tubs for water and oil; UP-48001-1-074 lifter; UK-1, UK-2, UK-6, UK-10 devices, and for pressing out suspension pins; GP-10-1 hydraulic press; pneumatic nut impeller; socket wrenches 22x27, 27x32, 32x36 and 14; wrenches 11x14, 14x17, 17x19, 19x22, and 22x27; 200g, 350g and 500g hammers; sledge hammer; crowbar; chisel; screw driver; punch; flat-jawed pliers; locking pin puller

(TABLE 1 cont.)

POST No.3

a) Trouble shooting and body repair

b) Welding generator with a kit of flexible pipes; GVR acetylene generator; oxygen container; welding torch and burner with kits of nozzles; shield and protective goggles; pneumatic and electric grinding and drilling tools; machine for boring pipes in the rocker arms; kit of models for preheater installation; torch (cutter); device for fender bending; sledge hammer; 14x17,17x19 and 19x22 wrenches

POST No.4

a) Assembly of side transmissions. junctions and running gear parts.

b) Stands for side transmission, rocker arms and torsions; rack for parts; UK-2,UK-8,UK-12,UK-13,TsP-1 devices and devices for running-gear mounting; pneumatic nut impeller; GP-10-1 hydraulic press; weight with plumb line; metal ruler; 14x17,19x22,22x24, and 27x32 wrenches; 500g hammer; sledge hammer; crowbar; chisel; 8 and 12 screw drivers; punch; pliers; locking pin puller; special crowbar(=spetslomik); 34.28.203 wrench; punch; clearance gauge(No.5 : set); 250 mm beam caliper; cans of graphite grease and minium; hair brush

POST No.5

a) Assembly of fuel tanks, control drives and seats.

b) Rack for parts; fitter's bench; No. 14,17,19 and 22 socket wrenches; wrenches of size 14x17,19x22,24x27,27x32; 500g hammer; axe; compass plane; chisel; screw driver; pliers; winches; No.12, 12.5, 13, 14, 15.5, 15 reamers; 500mm metal ruler; beam caliper

POST No.6

a) Installation of engine and transmissions (gear boxes) Assembly of the engine's systems, and of gear-box drives.

b) Stands for engine and gearbox; rack; TsP-3,TsP-5, TsP-3-1A,PS-4A,UPS-1A devices and devices for crankshaft cranking; pneumatic polishing machine; wrenches 11x14,17x19,19x22,22x24, 24x27,27x32; 500g hammer; crowbar; chisel; screw drivers No.3,4,8 and 10; pliers; reamers No.14.5, 15, 15.5, and 16; clearance gauge (set of 5); 500mm metal ruler; beam caliper; clamp 08-501; chalk; special crowbar; axe; compass plane; portable lamp; can of graphite lubricant

POST No.7

a) Preparation for stationary test and the test itself.

b) Manual pump for priming fuel from the set of hoses; storage batteries car; buckets for oil and water; wrenches for air-steam valve,34.28.95 stilb and 34.28.218; dipstick for measuring fuel and oil; 500g hammer; portable lamp(flashlight)

POST No.8

a) Preparation for road test.

b) Wire rope, wrenches and devices 34.28.14 stilb three for track tightening; special crowbar; socket wrenches size 19,22, 27,32 and 36; wrenches size 11x14,17x19,22x24,27x32 and 32x36; 500g hammer; sledge hammer; crowbar; chisel; pliers; winches

POST No.9

a) Removal of aggregates, junctions and parts from preservation. Assembly of (and replenishing of) aggregate sets, and their delivery to Posts No.4,5,6.

b) Stands for engine, gear box, steering clutches and PMP; wrenches (keys) 47001-1-018 MD, 47001-1-017 MD, 137.28.14 stilb, 137.09.028-2, 17x19,22x24 and 27x32; rack for parts; tub for removal of parts' preservation; chamber for removal of aggregates' preservation; pliers; can of US-1 lubricant.

TABLE 2.

SPECIALTY	Number of persons at POST No.								
	1	2	3	4	5	6	7	8	9
Master fitter	1	1	-	2	1	2		2	1
Gunsmith	-	1	-	-	-	-		-	-
Adjustment mechanic	-	-	-	-	-	1		-	-
Locksmith	1	1	1	1	1	1		1	1
Kit man	-	-	-	-	-	-		-	1
Welder	-	-	1	-	-	-		-	-
Electrician	-	1	-	-	-	-		-	-
Quality controller	-	-	1	-	-	-		-	-
TOTAL	2	4	3	3	2	4		3	3

ECONOMY IS POSSIBLE AND NECESSARY

p.60

LETTER TO THE EDITOR.

In an article entitled "Thriftlessness---No!" (See Technology and Armament, No.1,1963, V.STOLYAROV,Lt.Colonel,Engineer showed that in a unit the economical routine was seriously out of order in isolated cases. The journal's Editorial Office requested the Commanding Officer of this unit to report on any corrective measures taken. We received a reply that, due to neglect of duty, the facts which the article mentioned about fuel losses were indeed true.

For fuel economy a number of measures were introduced still in 1962. These made possible to considerably reduce the specific automobile fuel consumption per one ton of aviation fuel consumed, and to cut down the losses arising at fuel reception, storage and distribution at depots. For instance, the unit's efficiency experts worked out a method for draining the fuel from an aircraft in closed stream directly into the refueling truck. This method avoids fuel losses.

At the fuel depots, mechanized points are outfitted for draining the sediment from refueling trucks. This cut down fuel loss, and made possible the use of collected sediment for a direct purpose. Works were carried out for leakproofing the reservoir pool, for eliminating any leakage in the pipelines. Individual garrison automobile refueling points were outfitted. Measures were taken for a more proper use of TM-57 thermal engines which consume aviation fuel.

At the present time, a program of measures for fuel economy in 1963 is carried out. Standards were established for allotting technical means to the support of flight and parking days, depending upon the number of flying planes and conditions of operation. Technical means are not dispatched now to the airplane halting place, but they are concentrated at the airdrome support point from where they are requested by the airplanes according to need.

CHECKING THE SOUND RANGING OBSERVATION STATION

By: GOLOVKO V., Lt.Colonel,Engineer

p.61-62.

The SChZ-6 observation station for sound ranging is a set of acoustical electrical and radio engineering devices. Its work is reliable, but at the same time faults will sometimes occur in the operation.

We gathered some experiences which permit us to make recommendations for both the station's operation and the elimination of the most characteristic faults.

The station does not shift into the waiting position, and the volt meter shows a volyage which is considerably lower than the standard.

This fault may be caused sometimes by a bad connection between the storage batteries themselves (engaged "in series"). The same fault results if the plug of the register's (=recorder's) storage battery cord is incorrectly inserted into the female contact of the register's back plate. This happens when the plug is inserted with excessive force. An error in the connection is dangerous because the filament of tubes will be supplied with double voltage, and on this account all amplifier tubes may get out of order. Hence, after the faulty plug-insertion in the contact was corrected, the radio tubes should be checked without fail for their fitness. This requires the recording of popping on tape. The methodology of popping test is expounded in the INSTRUCTION for the Service of the SChZ-6 Sound Ranging Observation Station. Bad radio tubes are replaced.

The station does not shift into the working position when triggered from the warning post. In this case, the milliammeter readings of the reference instrument (KPP-reference trigger point) are checked at the warning post. If the amperage does not exceed 2 - 4 MA, the faults may be in the extension button:--the contacts do not disconnect, or closure developed in the cord. For checking this, the cord plug is disconnected from the reference instrument's plate and an ohmmeter is connected to it. While pushing the key button, we check the ohmmeter's readings. In good condition of the button, it shows "infinity"; in its bad condition, the arrow points to "zero".

When the milliammeter readings of the reference instrument are below standard, there may be full or partial leakage of current due to damaged insulation of the telephone wires which tie the central post together with the warning post. This trouble is easily found, since the milliammeter readings for the reference instrument are different from those for the repeater unit of the tested warning channel. In such cases, the exposed spots in the telephone wires are covered with insulation tape.

After deployment of the central post and sound post, the milliammeters of the repeater unit's amplifier and the sound post's reference instrument do not give readings for one of the sound channels.--In this case, they are shifted to single-wire communication line. If the situation does not improve, the amplifier's knife contacts and the repeater unit's terminal plate jaws for the given sound channel are inspected (there may be oxide deposit, dirt or lubricant on them). The flexible cable's shoe is also inspected. The setting of spring contacts and their good condition is checked. In case of sagging of the springs, without too much forcethey are lifted with the aid of a screw driver of narrow blade. Thereafter, the good condition of wires is checked in the flexible cable of the line control desk. The ohmmeter is connected to the block's pins and to the corresponding terminals of the flexible cable plate. If there is break in the wires, the ohmmeter shows resistance equal to infinity. In this case, the ohmmeter is best connected to the flexible cable which is then bent a few times while the readings are observed. Bad wires are replaced with spare ones which exist in the flexible jacket. The telephone wire connections with the terminals of the line board and reference instrument plates are also tested, because under the terminal's

nut lubricants and dirt can get on the wire insulation. Having ascertained that everything is in order here, the telephone wires are disconnected from the line board, an ohmmeter is attached, and the wire resistance is determined. Should the ohmmeter show infinity, it means that the wire is broken somewhere.

Contacts are cleaned with a rag soaked in gasoline or other solvents. It should be mentioned that gasoline and other solvents will corrode rubber parts, lacquers and paints. At cleansing the contacts, we must therefore watch out that solvents do not get upon these parts.

Defects are also encountered in the recording systems. If the recording system does not record sound signals, or records them with a very small amplitude, then the recording instrument, the repeater block, and the sound post's reference instrument should be also inspected and tested.

First the recording system is inspected. The pen may be strongly pressing against the tape, or the coil may be in contact with the case of the recording system magnets. The pen's position can be adjusted with a screw, then it is verified whether the coil is out of alignment. If the coil is out of alignment, it is properly fixed in the clamps. The recording system's knife contacts are also inspected. Between the contact jaws and knives, dirt and oxide and lubricants may accumulate.

To check the coil's good condition, the recording instrument is switched in, after the switch-over was put in the "pressure" or "parallax" position. If the recording system does not function, the coil resistance is measured. It should be 550 $\pm$ 15% ohms.

Sometimes a break of parts occurs at sites of soldering, or it starts from the radio tube system in the sound channel's amplifier block. To test the good condition of tubes, the tubes are shifted from one place to another. If this does not give favorable result, the tubes are replaced with new ones.

In the sound pickup, mechanical troubles are possible, or the adjustment of microphone resistance may be out of order. By turning the adjuster's nut the microphone is tested by popping. When this is not enough, the nut us put in a midway position, and the terminal screw is relaxed so much that the microphone hub should take an arbitrary position, and then the screw is tightened as fas as it will go.

The pins of shoes (lugs) of the cables which connect the amplifier block and the recording instrument are also inspected. If the whole recording system does not record sound signals, the lines of communication are tested. We measure the voltage in the storage batteries that supply the filament circuit of amplifiers. If the voltage is low, the battery is changed.

Wire break in the " - 6" cord of the recording instrument's storage battery can be determined with an ohmmeter. The good condition of the anode rectifier is tested by pressing the voltmeter's button, with the recording instrument started. If the rectifier is in good condition, the voltmeter indicates an anode voltage. The contacts are also checked. If the call signal of the central post does not reach the sound post or the warning post, the trouble should be looked for in the amplifier block. It may be caused by faulty adjustment of the buzzer contacts. Before adjustment, the locknuts should be loosened. When the buzzer tone is adjusted, the call buttons "ZVP" and "PRD" (sound post and warning post) should be alternately pressed. Here, one should make an effort to keep the buzzer tone pitch roughly the same. Moreover, if the two buttons are not pressed during adjustment, it could happen that one of the call circuits would not get adjusted. From buzzer contacts, scale is removed with glass paper or with a notched plate. After cleansing, the buzzer is adjusted.

MORE TIME IN WORK, LESS TIME IN SERVICE MAINTENANCE

By: SKVORTSOV I., Colonel, Engineer and

MAKAROV V., Major,

p.63-65

The maintenance of engineering machinery takes very much time. Not a little time is also wasted on removing defects detected in operation. Of course, the task is to look for ways to shorten labor expenditure and to reduce the time spent in maintenance.

On the engineering machinery, especially after an operation under increased dustiness, the lubrication points get covered with dirt, and a hard crust is frequently formed in the top layers of lubricant greases, which can be removed with a hydraulic punching pin only. But even after careful cleansing and washing, cases are possible when, together with the new lubricant, mechanical admixtures get into the frictional clutch, which results in a too early wear off of parts.

To avoid contamination and hard crust formation at lubrication points, it is best to mount on the pressure lubricators plastic or rubber caps that are easy to mount and dismount, to stick a piece of insulation tape or other materials that do not let dust or moisture through. This will cut down the time spent on greasing by approximately 50%, and it will increase the service life of the maintained interconnections.

During the past year the quality of both the lubricating materials and the friction surface treatment has improved. Hence, some points of the engineering machinery can be lubricated now at longer time intervals. As practice showed, on the D-144 road grader the interconnections can be lubricated twice less frequently than provided in the Instructions. This saves considerable time. Neither is the wear off of the interconnected parts increased. Maintenance time can be cut down if rubbing parts which are not provided with lubrication adapters are washed with kerosene. This is best done during the No.2 Technical Maintenance Service only.

Unification of lubricating materials, of which more than thirty kinds are used in the engineer troops, will also contribute to cutting down the maintenance time of vehicles.

To lubricate friction points with gasket packings, the lubricating greases are usually forced under pressure until the old lubricant comes out. Such a lubricating method will frequently damage the gasket packings. After two-three such lubrications, roller bearing basket packings of vehicles on S-80, and S-100, BAT and BTM tractor base will get out of order. To prevent this, it is best to mount pressure gauges on the solid-oil gun which make possible to control the lubricant's pressure. At a -5 to 25°C environmental temperature, this pressure should not exceed 6 - 8 kg/cm^2.

Vehicles of medium complexity (KMM, K - 51, D - 271, D - 144 and so on) have more than 2000 fastenings. The condition of the most vital fastenings is best checked at control inspections and at the daily maintenance, while the condition of all the fastenings is usually checked at the No.1 Technical Maintenance Service. During operation of the machinery it was found, however, that it is adequate if fastenings which work under pulsating and sign-shifting loads and under changing temperature are checked at the No.1 Technical Maintenance Service. Yet, particularly important fastenings (running gear and steering control) are to be checked at the daily maintenance service. In our opinion, fastenings which work under static loads can be checked at the No.2 Technical Maintenance Service only.

To facilitate the testing procedure, specially important fastenings are best marked with paint, for instance, with yellow paint, and fastenings that work under pulsating and sign-shifting loads are marked in blue or in other color.

When pontons of the Infantry Support Tank Unit's park are moved up onto the base vehicle, because the winch gets disconnected at an improper time, the winch ropes are damaged and broken, fissures appear on the pullery blocks and winch drums, the pontons are incorrectly set up, and the props will tear away. The elimination of these damages takes much time, and it increases the wasted time of the machinery. For the prevention of such damages, we think it best to put a stop to the loading movement of pontons (Fig.1). The outline of its wiring is given in Fig.2. One wire is connected to Signal 7, and the other to the ground.

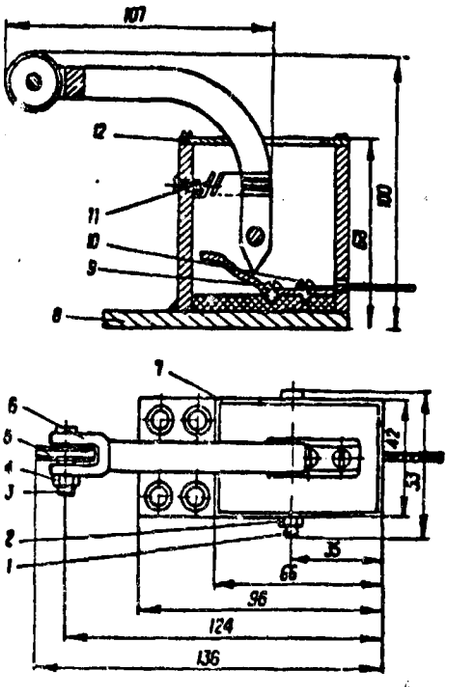

FIG.1. Stop for the movement of pontons. (p.63)
1...axle; 2...M-6 nut; 3...axle; 4...M-6 nut; 5...roller 25mm; 6...lever; 7...housing; 8...footing; 9...contact spring; 10...screw; 11...spring; 12...cover.

The ponton movement stop is set up on the platform in front of the support. During the ponton's movement, its front part acts upon Roller 5 (See Fig.1), the long end of G-shaped lever 6 turns around Axle 1, while the short lever end contacts Contact 9, and switches in a sound or light indication. According to the indication, the driver will cut out the winch.

Similar contact-type device is desirable to have on all machinery of the wire-cable-winch system (KMM and BAT).

If maintenance is adequately organized, its time is considerably reduced. Experience showed that where specialized maintenance teams (squads) are created, there the repair equipment is more economically used, the machinery maintenance time is reduced, and cases of premature troubles are excluded.

To carry out the numbered maintenance for the engineer unit and podrazdelenie equipment, teams composed of 5 persons are usually created. The team includes: a squad commander (he is also an adjuster mechanic), a carburetor electrician (he is also a mechanic for testing and adjusting the Diesel fuel apparatus), a lubricating man, a fitter, and the driver of the serviced vehicle. At the maintenance point, each team arranges for itself a working place, or prepares a stand in the parking area. In the general program of measures

for machinery maintenance, simultaneous work is provided for all performers. With such a maintenance organization, all these works reach a high quality level, and the idling of machinery is reduced.

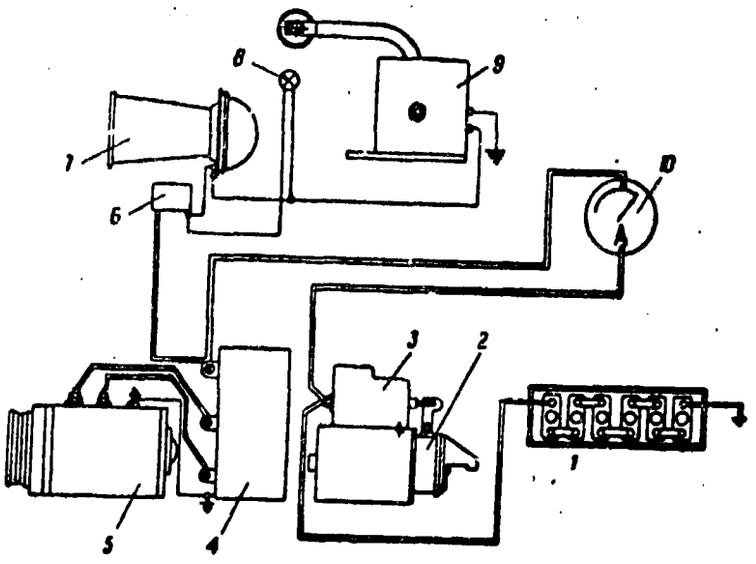

FIG.2. Wiring outline of the stop for the movement of pontons.

1...storage batteries; 2...starter; 3...starter tripping relay; 4...relay controller; 5...generator; 6...fuse (protector); 7... sound signal; 8...indicating lamp; 9...ponton movement stop-- and contactor; 10...ammeter.

CONNECTING RADIO LINK

(8 Figures)

By: KARDASHOV I .,Captain, Engineer

Pages 68-71

Unit radio stations set up in Point B can be controlled from Point A by a connecting radio link which is formed with the aid of R-105 radio stations, or by UKV(=ultrashortwave) radio stations of other types. With such a radio link, the operation is performed with telegraph key in the AM and ChM mode of operation, with an ST-35 by simplexing and duplexing, and with the Baudot apparatus (=printing telegraph). Key-sent transmissions can be also relayed.

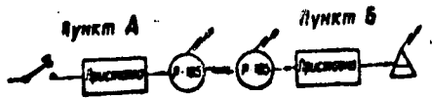

FIG.1. Radio link for simplex communication

(On Fig. : Point A--Unit --R-105--R-105--Unit--Point B)

For simplex communication, the radio link is formed from two R-105 radio stations (Fig.1), and for duplex communication it is formed from four R-105 radio stations (Fig.2). When the radio stations print the accepted message, signals at Point B are transmitted to Point A. When there is a keyed operation, the signals commence at the receiving point.

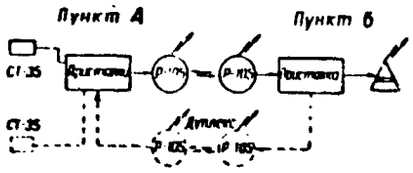

Fig.2. Radio link for Duplex communication.

(On Fig.: Point A---St-35---Unit---R-105---R-105---Unit---Point B
St-35 (Duplex)R-105---R-105---)

Let us look at the main circuit diagram of the unit which we prepared (Fig.3)

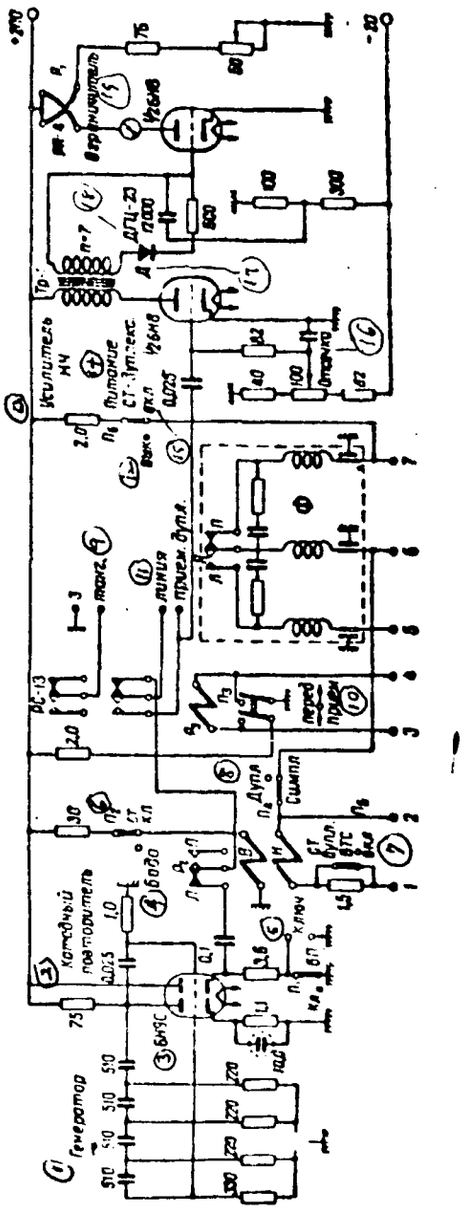

Fig.3. Main circuit diagram for the remote control unit of radio stations and for the relaying of telegraph transmissions.

(On Fig.: 1...generator; 2...cathode follower; 3...6N9S; 4... Baudot apparatus; 5...key; 6...P_2 St key; 7...St dupl.,VTS switch; 8...dupl/simp; 9...tangent; 10...transmission reception; 11... line/reception dupl.; 12...switch; 13...amplifier NOh; 14...feed of St duplex; 15...switch; 16...cut-off; 17...D; 18...DGTs-23; 19...limiter).

On a 6H9C tube, we hook up an RC-generator which produces oscillations of 1000 cycles frequency, and a cathode follower which matches the generator's output with the R-105 radio station's input. In the generator, a four-section phase-shifting filter is used. With switched in load, its output voltage is 0.5V.

On one half of a 6H8C tube an accoustic signal amplifier is hooked up, and on the other half a limiter. Since the voltage which from accoustic signal Rectifier D reaches the limiter's grid is several times larger than

the cutoff voltage of the tube, the rectified signal repeats the rectangular pattern of telegraph sendings. When there is no signal, the tube is open. At this time, current is flowing through the limiter's anode circuit, and the armature of Relay R_1 flips over to the right contact. When signal comes, the tube is cutoff, and the relay armature flips over to the left contact.

For keyed work on the unit at Point A, Changeover Switch P_1 is put in the "kl" position, Switch P_2 in the "st.kl" position, Switch P_3 in the "transm." position. In this case the armature of Relay R_2 is on the left contact, the tangent circuit is closed, and Radio Station R-105 is switched in for transmission. When the key is pressed down, the audio frequency voltage comes to the modulator of Transmitter R-105 through the closed contacts of Relay R_2 and R_3.

At Point B, Changeover Switch P_3 on the unit is put in the "reception" position, and the signals received on the audio amplifier input come through the contacts of Relay R_3. Then, they act upon the limiter grid. The tube is cutoff, and the armature of Relay R_1 flips over to the left contact. The key circuit in the short wave transmitter is closed through Terminals 5 and 6 of the unit, and the transmitter operates. When there is no signal, current of standard intensity will flow through the limiter tube and the winding of Relay R_1. The armature of Relay R_1 flips over to the right contact. The key circuit of the shortwave transmitter is broken.

In the ChM mode of operation also, the shortwave transmitter is similarly controlled. When the armature of Relay R_1 is closed with the left contact, "press" frequency is transmitted. If the key circuit is opened, "release" frequency is transmitted.

For simplexing work of the ST-35 apparatus, Changeover Switches P_2 and P_3 are left in the same position as they are during key work, Switch P_1 is put in the position "bp", Switch P_4 in the "simpl." position, Switch P_5 in the "vykl." (disengaged) position.

At Point A, the telegraph apparatus is set into operation "by itself." Since shortwave radio stations and telegraph stations have their own line batteries, Changeover Switch P_6 on the unit is disconnected. During transmission, Changeover Switch P_3 stays in "transmission" position, and during reception it stays in "reception" position.

When the ST-35 apparatus is in operation, the pulses pass through Winding N of Relay R_2 (Fig.4). In the case of current sending, the relay armature flips over to the right contact; in the case of currentless sending (under the effect of the current which passes through Winding V), it flips over to the left contact. At the input of Station R-105's modulator, sound voltage enters only at currentless sendings. During transmission, the armature of Relay R_1 is closed with the right contact.

At Point B, by a signal's action, received at Radio Station R-105, the limiter tube of the unit will be closed. The armature of Relay R_1 flips over to the left contact, the line battery circuit is interrupted, and the shortwave transmitter sends "release" frequency (Fig.5).

With current sending, the audio frequency voltage is not admitted to the input of Radio Station R-105's modulator at Point A. The limiter tube of the unit, located at Point B is open. The armature of Relay R_1 flips over to the right contact, the line battery circuit is closed, and the transmitter sends "press" frequency. Thus, the shortwave transmitter is manipulated in accordance with the combinations sent from Point A.

Signals received by the shortwave radio station are transmitted to Point A. For this purpose, the unit at Point B is moved into the "transmission" position, and the unit at Point A into the "reception" position. The line battery circuit is controlled by the signals received with the printing received. In this circuit, the pulses of current act upon Winding N of Relay

Signals received by the shortwave radio station are transmitted to Point A. For this purpose, the unit at Point B is moved into the "transmission" position, and the unit at Point A into the "reception" position. The line battery circuit is controlled by the signals received with the printing receiver. In this circuit, the pulses of current act upon Winding N of Relay R_2, while through its contacts the relay keyes the buzzer set of the unit at Point B. At Point A, the signals received by Radio Station R105 control the line battery circuit.

From reception to sending to Point B, the unit can be shifted by two methods:----manually, or automatically by a signal sent from the end shortwave radio station. For this purpose, the receiver's line battery is connected in advance with Terminals 3 and 4 of the unit. This battery gets closed on the Winding of Relay R_3 when the shortwave transmitter of the end station emits a signal of a frequency corresponding to "press". In this case, the unit and Radio Station R-105 pass over into the operating mode of "transmitting". If, however, "release" is sent, the circuit of this battery is interrupted, the unit and Radio Station R-105 pass over to reception. At this method, Changeover Switch P_3 is in the "reception" position. If the quality of work is to be checked, the motor of the ST-35 apparatus is switched in.

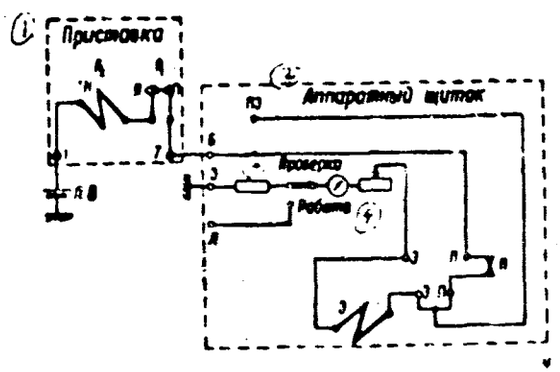

FIGURE 4

Diagrammatic connection of the unit with the ST-35 apparatus at Point A for simplexing work.

(On diagram): 1...unit; 2...apparatus board; 3...check; 4...work.

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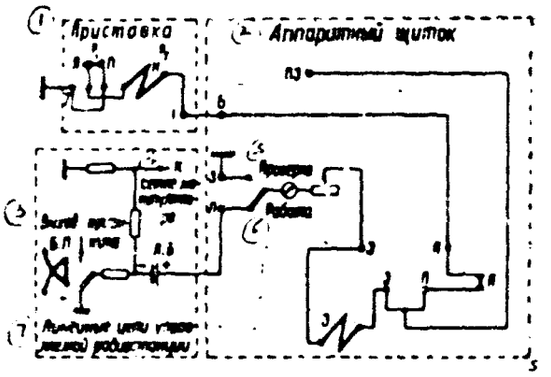

FIGURE 5

Diagrammatic connection of the unit with the ST-35 apparatus at Point B for simplexing work.

(On diagram): 1...unit; 2...apparatus board; 3...receiver output; 4...keyer grid; 5...check; 6...work; 7...line circuit of controlled radio station).

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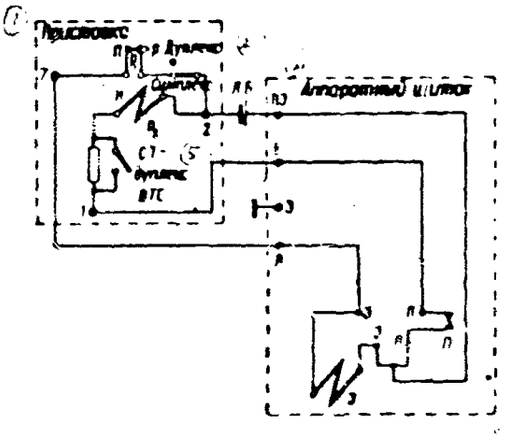

FIGURE 6

Diagrammatic connection of the unit with the ST-35 apparatus for duplexing operation (without transmission control).

(On diagram): 1...unit; 2...duplex; 3...simplex; 4...apparatus board; 5...St-duplex VTS)

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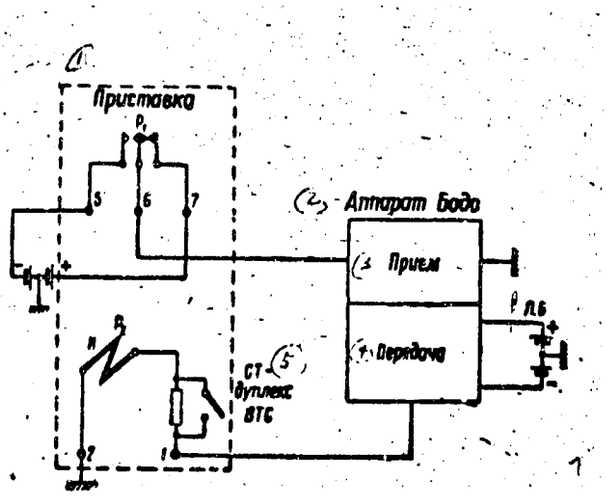

FIGURE 7

Connection of the unit to the BAUDOT apparatus at Point A.

(On diagram): 1...unit; 2...Baudot apparatus; 3...receition; 4...transmission; 5...ST-duplex VTS.

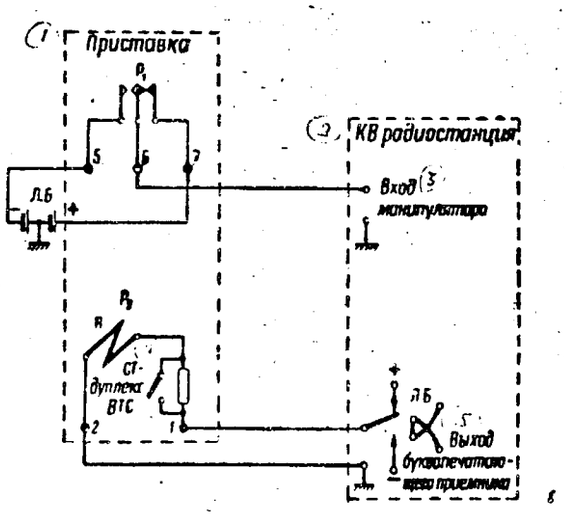

FIGURE 8

Connection of the unit to the shortwave station at Point B.

(On diagram): 1...unit; 2...shortwave station; 3...input of key; 4...ST-duplex VTS; 5...Printing receiver output).

For duplexing operation of the ST-35 apparatus, both units are in the "transmission" mode of operation (Figure 6). Transmitting Radio Station R-105 is connected with the units, just as in a simplexing operation, i.e., with the "line," "tangent", "ground" terminals. Receiving Station R-105 is connected with the "reception duplex" and "ground" terminals of the units.

The transmission can be controlled only if the unit is connected with two telegraph apparatuses, one of which operates on reception, the other on transmission. In this case, Changeover Switch P_4 is put in the "duplex" position, Switches P_6 and P_5 are "switched off", while the units are connected with the apparatus boards in the way as shown in Figure 4, only with the difference that the transmitting telegraph apparatus is connected to the apparatus board and to the line battery with Terminals 2 and 1, while the receiving apparatus is connected to them with Terminals 6 and 7.

At Point B, the unit control organs are arranged in the same way as at Point A. Since there is no line battery in some types of radio stations, on the transmission side the feeding is provided by the unit. For this purpose, Changeover Switch P_6 is put over into the "closed"position. If in the shortwave radio station the teleprinter's line output is connected with the local telegraph apparatus, the signals received at Point A are sent so as shown in Figure 5, although in this case the unit is connected to the apparatus board with Terminals 1 and 2. If the receiver's line output is however not connected to the local apparatus, this receiver is directly connected to Terminals 1 and 2 of the unit. The transmitter key input of the shortwave radio station is connected with Terminals 6 and 7 of the unit. The keyed operation is accomplished by the contacts of Relay R_1, which interrupt the line battery circuit. Operating Relay R_1 is controlled by signals which are sent from Point A. Filter F which is inserted in the circuit of the contacts of Relay R_1 eliminates interferences.

The BAUDOT apparatuses work by bipolar sendings. For duplexing communication, Changeover Switch P_2 is placed into the "Baudot" position, and the Switch P_6 into the "disconnected" (open) position. The position of the rest of control devices is the same as during a duplexing operation of the ST-35 apparatus. The connection of the unit at Point A is shown in Figure 7, while at the shortwave radio station it is shown in Figure 8.

For relaying the transmission by key, the unit is put into the "reception" position. The receiver's audio output is connected with the tonal amplifier input of the unit. Terminals 5 and 6 are connected with the jacks of the transmitter key.

Service communication between Points A and B is made only during interruptions (gaps) between reception and transmission radiograms. The units can feed from an alternating current network, or from battery. Relay R_2 of the unit has Winding N of 270 ohms resistance, and Winding V of 2700 ohms resistance. This relay can be exchanged for another---- for Relay RP_4 with shunted windings.

The units were tried out under field conditions, and they showed good results.

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For The Extension of the Service Life of Vehicles

STAVROV B., Lt. Colonel,

RELIABLE CARETAKING FOR AUTOMOBILE TIRES

p. 72 - 74

Drivers of the motor transport battalion which is under the command of Lt. Colonel YU. TUROVETS became initiators of a campaign to prolong the service life of automobile tires, and they took on the obligation to increase the tire run by 3% to 5%. What will be the economical effect of this? Let us analyze an example.

Suppose, a podrazdeleine has 20 ZIL-164 motorcars with 140 tires. If the run of these tires is increased by 5%, seven tires can be saved. Financially speaking, this means slightly more than half the cost of a new ZIL-164 motorcar.

When we determine the sinking run of a tire,----which we should do frequently-----the concept of "tire run" and "motorcar run" should not be confused. Some think that the run of each tire mounted on a motorcar equals the run of the automobile from the moment the tire was installed on the vehicle. This is actually not so.

To determine the run of a motor car on which simultaneously installed tires work for a positive time, the sinking tire run (e.g. for the GAZ-69 this sinking run equals 30,000 km) must be multiplied by the number of wheels mounted on the motorcar (together with the spares), and divided by the number of simultaneously working wheels, i.e., 30,000 x 5 : 4 = 37,500 km.

The run of other brands of motorcars can be calculated exactly the same way, if the wheel rotating was not forgotten. Thus, for the GAZ-51, ZIL-150 and ZIL-164 motorcars the sinking run is 46,000 km; for ZIL-151 it is 48,000km, and for GAZ-63 it is 50,000 km.

Consider some of the causes which result in tire wear.

It has been established that a 25% drop in tire pressure will shorten the tire run by more than 40$, and if the pressure drops by 35%, the tire run decreases by 60%. If pressure is low in common-brand tires, they can twist around the wheel, and the inner tubes may get damaged. Sudden drop in tire pressure is especially dangerous; it can result in breakdowns. But increased pressure is not permissible either. If the pressure is 25% above the normal, the tire run will be shortened by 20%.

Overloading of tires will sometimes arise due to improper load distribution of the car floor, and, naturally, a 25% overload will reduce the tire run by 40%. It is not just an accident therefore that heavy but small-sized loads are put down near the driver's cab, while lengthy loads are transported on motorcars with single-axle trailer. In all cases, the load should be reliably fastened. Overloading of tires may also happen if the tires of double wheels are inaccurately matched, or if single tires are mounted on them, which happens many times. Motorcar defects will also cause untimely tire wear. Increasing the angles of front-wheel toe-in and camber leads to quickened tread wear of the tire.

The same will also cause wear in the bushings, pivots, and stub axle spindles of wheel bearings, play in the articulated steering rods, and improper brake adjustment.

A few drivers forget that long movement at speeds over 50 km/hour will contribute to untimely tire breakdown. Observations show that long movement of a loaded motorcar at 60 km/h speed reduces the sinking tire run by 20%, and movement at 80 km/h speed will reduce it by 40%. Sharp turns at great speeds lead to mechanical wear of the tire tread. Careless crossings of various road obstructions provokes mechanical damage in the tread and in the tire carcass.

It is not uninteresting to recall also that movement along country roads of rocky ground doubles tire wear, and gravelly ground increases tire wear 1.35 times compared to the wear on bituminous surface roads.

In winter, especially when there is severe frost, at the start of movement the speed should not exceed 5-10 km/h. The point is that tires are less elastic at low temperatures. Such a speed will be useful to warm up the tire and motorcar units. Chains against skidding should be used only in passing difficult sectors, since the use of chains increases tire wear.

In hot weather, after long rounds, if the situation permits, it is best to stop after every 3-4 hours of movement to let the tires cool down. In this case, it is not allowed to let air out of the inner tube, since in the cool tire the pressure will be lower than normal. When we look at these figures, it is easy to understand how injurious tire overheating is. If the temperature rises to 100°C, the reliability of the rubber ties with the cord in doubly diminished, and the tire strength decreases to its half or third.

Tires of the ZIL-157 motorcar which has centralized air inflation can be also used when their pressure is down, but this condition should not be abused. After passing through the difficult road sectors, the tire pressure should be brought up to normal.

Parking of motorcars on deflated tires and lengthy parking of loaded motorcars is not permitted. If special equipment is mounted on the motorcar, and in the case of lengthy parking of any vehicle, they are put up on blocks.

When motorcars are parked outdoor, exposed to sunlight and environmental atmosphere for a long time, the tires will gradually "age":-- the rubber loses its elasticity, a fine network of cracks will appear on its surface through which moisture penetrates and breaks down the cord. Tires should be therefore painted with AKS aluminum paint, or even covered with shields, mats, and canvas covers.

It is well known that tires are issued with different tread patterns, corresponding to certain conditions of the motorcar's work. Thus, when motorcars move mostly along hard-paved roads, it is best to use tires with road-pattern tread. Tires of universal tread pattern are best for hard-paved roads and dirt roads. Tires whose tread is finished with an increased cross-country ability pattern are intended for vehicle operation along difficult dirt roads and under conditions of lack of roads.

If a motorcar is to get new tires, it is desirable to put them up on all wheels at the same time, or on the front wheels only, or on the

rear wheels only. At installation on double wheels, used tires are selected so that their difference in diameter should not exceed 5 mm, while the tread pattern should be the same.

The service life of tires depends to a considerable extent upon correct mounting and disassembly work, which is best done on a specially outfitted place of the maintenance post. Under field conditions, such works are done at a clean sector of bituminous or concrete road. On dirt roads they are performed on tarpaulin, or on the floor of the motorcar's body.

The tire is mounted so that the tire pointer, or in its absence the grouser's tip, should coincide with the direction of wheel rotation at the motorcar's forward movement. Neglect of this rule ruins the tread's capacity to clean itself from dirt or snow.

Many drivers unscrew the slide valve, when they inflate a tire. This should not be done, because the slide valve and the valve thread can be ruined.

In conclusion, we should like to wish that questions of the service life extension of tires would concern not only officers of the Motor and Tractor Service, but also everyone who one way or another has something to do with motorcar operation. For this purpose, they should well know the rules of tire maintenance and operation, and they should daily enforce their observance by their subordinates.

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GALYAMIN M., Lt. Colonel

FOR UNIFIED SUPPLIES

p. 72-73

Today in the District two independent sections supply the units with materiel resources for the repair and operation of armored equipment and motor-tractor equipment. Each section has a subordinate depot.

The units also have one depot, but stock-taking differs by both nomenclature and names, although the stock is now and then identical (for instance, parking and garage outfit, lacquer and dye material, cutting and gauging instruments, and so on), and it is meant for the same equipment.

The question is whether such a duplication is necessary. Certainly not! Nevertheless, it exists not only in stock-taking and storage, but also in bookkeeping. Each service sets up its own forms and presentation dates.

Naturally, the senior chiefs' directives are followed, but only formally. In fact, the picture of the situation is somewhat different. Thus, the technical deputy commander expends property regardless of which service gets it. And his reasoning about this is as follows. He is responsible for the condition of both the armored equipment and the motor tractor equipment. Therefore, he is chiefly interested that the whole materiel unit be kept at constant combat readiness.

Many examples can be quoted to illustrate the shortcomings of the present supply system.

Let us take the park-garage and bench machine equipment. Well, you see, it does not take too much time when it gets difficult to find out to whom the equipment really belongs. Hence, you may understand, the same equipment is recorded for two services. It is not impossible that those who finally add these data together will conclude that the equipment supply is at normal level, whereas it cannot be and is not so in reality.

Still greater is the duplication which developed in the provision for tank instruments and devices. Here, all the land force services take part. For instance, tank instruments are provided by the Directorate of Tank Forces; combat engineer instruments by the Directorate of the Corps of Engineers, and instruments and devices for arming by the Artillery Directorate, and everything that refers to radio stations by the Directorate of the Chief of Signal Forces. To get a missing stock item, one has to turn to various organizations, and now and then you even don't know which one can help you out. For instance, trailers are supplied by the Artillery Weapons Service, and electric light bulbs for the trailers are supplied by the Armor Directorate, radio stations by the Signal Service, and helmet phones again by the Armor Directorate.

The Motor Tractor Service deals with vehicles on which tank units and running gears are mounted. For repair, such equipment must be sent by the motorists sometimes to a distance of several thousand kilometers, at great expense. Yet, this work could be also performed locally by the tank maintenance enterprises, but higher authorities had not permitted this. All this makes the work difficult, and impossible to operatively solve a few practical problems.

Life urgently demands that the repair and supply organs of tank armament and motor tractor equipment be unified.

The pages of this journal previously started a discussion on the desirability that the armored and motor-tractor service should have unified directives. All the spare parts, instruments and devices (=ZIP) for tanks and fo SNU(=) should be supplied by the Armor Directorate. But ceilings should be set in the corresponding sections and services, or else the parts should be centrally supplied by the depot of armored stock. It seems to us that the elimination of duplication in supply would considerably improve troop support; it would liberate the technical deputy commander for unneeded correspondence.

A favorable solution of the problems which we touched would be a practical response to the directive which the November Plenum of the Central Committee of the Communist Party of the Soviet Union proclaimed concerning the centralization of leadership and perfection of management methods.

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SCIENCE AND PRODUCTION

PATON B., Academician, President, Academy of Sciences, USSR

WELDING TODAY AND TOMORROW

p. 75-80

The November plenum of the Central Committee of the Communist Party of the Soviet Union emphasized with renewed strength that the newer achievements of science and technology must be fully utilized in national economy, because it is otherwise hardly imaginable that the material technical resources of Communism could be successfully created. As well known, one of the important trends of technological progress is the large-scale complicated mechanization and automation of production, including welding production. Today people discuss the creation and introduction of production lines and automated lines and bench trains for sectional welding.

Mechanization and automation assure a marked increase in labor productivity. It was established that at the enterprises where mechanized welding is used instead of manual welding, labor productivity almost quadrupled as an average. At present, in our country almost 45% of welding work is mechanized, and the labor productivity of an army of many thousand welders increased approximately by one and a half times. The Soviet Union is the first in the world in regard to the volume of such mechanized welding methods as electric slag and under flux. Ours is also the first place in regard to the production rate of welded structures and the output of rolled metals. The second place belongs to the German Federal Republic, and the third place to the USA.

Last year, our country advanced far in the development of fusion works. Thereby, labor productivity can be doubled, worn-out machinery parts can be put back in operation, two-layer and multi-layer parts can be made which are highly resistant to wear and tear. Fusion works spread particularly widely in metallurgic industrial enterprises, in repair enterprises of the Ministry of Transport, in rural economy as well as in the Armed Forces where fusion works are used in restoration of rapidly wearing-out parts of tanks, artillery tractors and other types of military equipment.

On occasion of the XXII Session of the Communist Party of the Soviet Union, Comrade N.S. KHRUSHCHEV said: "While building the communist economy, we cannot tolerate conservativism in technology. As the proverb says, you cannot clear high hurdles with old horses!". This suggests our task: ----to be persistent in perfecting the welding technique, in searching for newer, more efficient methods and technological procedures in welding.

FROM THE WELDING ARC TO THE ELECTRON BEAM

A quarter of a century ago appeared the powerful electric closed arc which heats under flux. In a number of cases, it permitted that the metal had not to be sent to the place where the welded seam was laid on. Yet, this method made it necessary to melt admixture metal, i.e., metal brought from without, and to leave a gap between the edges. Something similar occurs also in resistance butt welding when the surface of the conjugate parts is to be melted. (p. 76). For instance, for welding two railroad rails, not less than 2-3 kg steel has to be melted, or rather, burnt.

Such a shortcoming is not found in the method of welding a thin metal with wolfram electrode in a steam of inert gases (argon, helium), a method which was worked out in the forties. The seam is formed only at the expense of melting the weldable edges. However, unfortunately, this particular method limits the possibility to increase the power of arc, and therewith also to enlarge the thickness of welded articles.

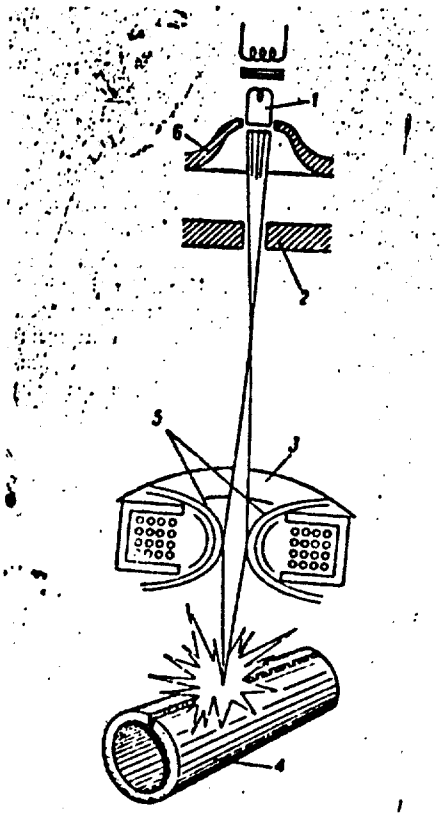

FIGURE 1

Model outline of electron-beam welding.

1...cathode; 2...anode; 3...electromagnetic lens; 4...welded article; 5...magnetic power line; 6...focusing electrode.

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The so-called electron-beam welding appeared recently. Its essence is that the welded article is placed in a vacuum chamber where it is bombarded with powerful sharply focussed electron bundles which eradiate

from the cathode of a special electron gun (Figure 1). Due to the great difference between cathode and anode potentials, the electronic current is accelerated, and it is focussed with a magnetic lens upon a zone which has a diameter of a few tens of millimeter. The specific power reaches tens and even hundreds of kilowatts per square millimeter.

The vacuum created in the welding area permits to weld chemically highly active refactory metals: ----molybdenum, wolframium, niobium, chromium, and other metals used in atomic, rocket and radio electronic equipment. Due to the larger, preiously unprecedented concentration of power, a possibility opened for the welding of 40-50 mm thick metal, without dressing the edges, without leaving gaps, or adding admixture metals. The U-3 type set for electron-beam welding which is for welding of ring-shaped and straight-line seams is shown in Figure 2.

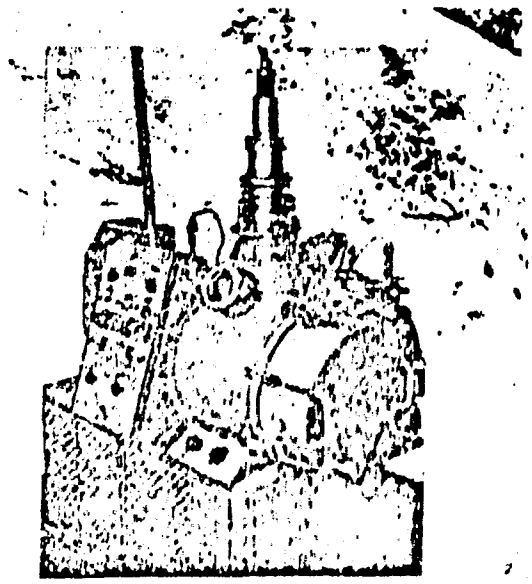

Figure 2
The U-3 type set for electron-beam welding

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The electron-beam heat source made possible to find principally new solutions in qualitative metallurgy, too. It makes possible to simultaneously melt and refine metals, to obtain alloys and monocrystals of a high degree of purity. The powerful electron gun will melt in vaccum an electrode made from an initial material contaminated with admixtures (Figure 3). The metal, purified in a water-cooled crystallizer, is shaped into an ingot which is characterized by its purity, high plasticity and resistance to corrosion.

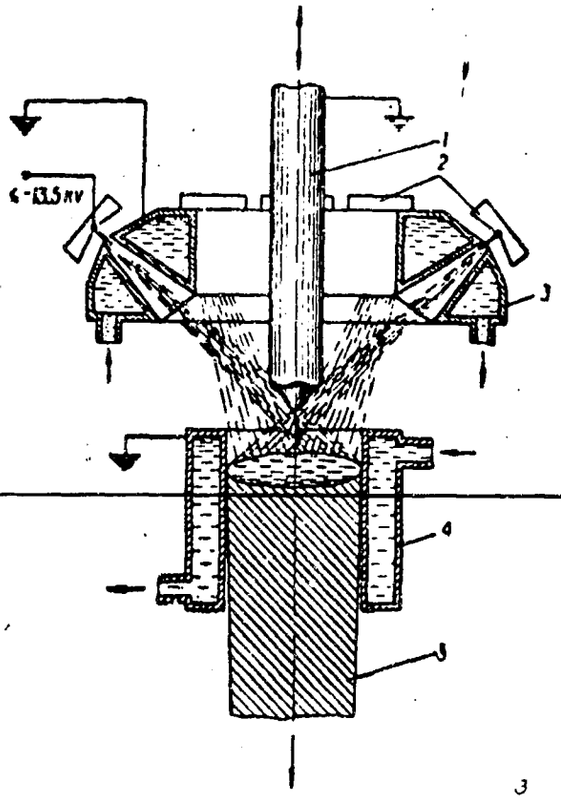

FIGURE 3

Diagram of electron-beam smelting and refining of metals.

1...remelted bar; 2...cathode component; 3...accelerating anode; 4...water-cooled crystallizer; 5...ingot.

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It should be said, however, that not even the electron-beam heat source is most perfect any longer. Quantum-mechanical generators (lazers)[1] are soon coming into the welding service, which produce super-powerful bundles of light energy. These bundles remind us of the rays described in A. Tolstoy's novel "Engineer Garin's Hyperboloid", which, as we see it, are transplanted from the world of fancy into the world of reality.

Information is now available on welding of refractory metals with the aid of such generators. In difference from electron-beam, the lazer beam can weld directly in the open air so that vacuum is not necessary at all. While coming in contact with the welded edges, the beam's photic energy is transformed into heat large enough to (p. 77) melt the most refractory material (Figure 4).

FOOTNOTE 1: See Technology and Armament, No. 10, 1961, p. 74-80.

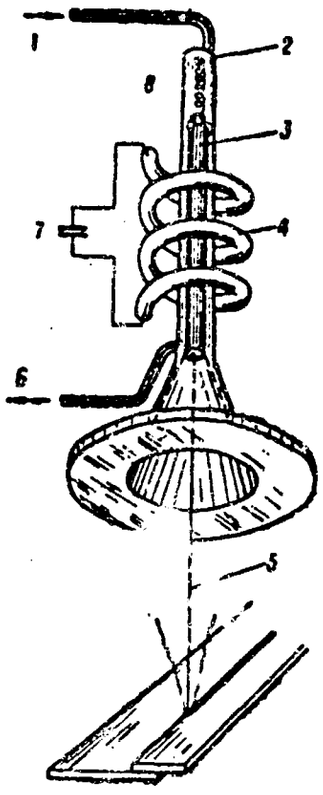

FIGURE 4

Model diagram of lazer welding.

1 and 6...input and exit of coolant; 2...glass tube; 3... housing; 4...pulse lamp; 5...outgoing bundle; 7...source of power; 8...spring.

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The use of radio-frequency currents also opens great possibilities. They make possible the production of heat locally, but mostly a ten-fold increase in the speed of welding compared with the speed of arc welding. A procedure was worked out to weld pipes by radio-frequency currents with induction supply of power to the billet. Its introduction at the Nikopol Rolling Mills for Tubes gave possibility to a twenty-fold increase in the productivity of stainless-steel pipe welding compared with argon-arc welding.

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THE ARSENAL OF WELDING TECHNIQUE IS NOT EXHAUSTED

At present, emphasis upon procedures for melting the weldable metal is one of the fundamental trends of welding development. But, is it necessary to make the metal melt for gaining a solid joint of the welded parts? Modern ideas concerning the nature of interatomic bonds admit to give a negative response. Two metal parts do not need to be melted to form an indivisible joint. It is entirely enough to press them together, and to secure such a mobility of atoms on the conjugate

surfaces which would make possible to establish bondage between "alien" atoms. To wit, the so-called cold welding is built upon such a principle. In the meantime only soft metals: aluminum and copper, can be welded by this method.

But how is it with steels and refractory metals? As it is well known, in addition to compression, they also require preheat in vacuum to avoid oxidation or nitration of the conjugate surfaces. Thus, one of the most prospective welding methods, the diffusion welding in vacuum, originates. With this method, even today it is possible to weld metals, non-metals, metals with non-metals as well as to successfully replace contact welding for melting. The use of this method completely excludes the expense of burnt metal, and reduces several-fold the power of equipment needed for compressing the welded parts,

The general trend in welding development is to discontinue metal melting. To this end, the use of ultrasound vibrations, friction forces, explosion power is considered for the joining of conjugate parts. This does not mean, however, that metal melting will be entirely excluded from welding routine. Parallel with arc welding, electron-beam and light beam welding, ionic rays, incandescent plasma, and finaly heating of the weldable edges with the heat of subdued nuclear reaction can be used. By the way, some of these methods are used now, e.g., welding with ultrasound vibrations for the joining of thin components of non-ferrous metals.

The type of "nuclear welding" will spread at which the combination of lithium and boron is placed upon the weldable surface of two substances. They work exactly as a peculiar "nuclear glue". During irradiation with neutrons, nuclear reactions arise in these chemical elements. These reactions are accompanied by an instantaneous liberation of a great quantity of energy which heats up the adjacent edges to hundreds and even thousands of degrees temperature. The strength of "nuclear welding" fully answers the requirements.

We suppose that welding is getting closer and closer to glueing; that the very term "welding" (svarka ; s-varka=boiling into one) is steadily becoming an anachronism. You see, metal does not boil ("varit"), i.e., it does not turn into a liquid state. TRANSLATOR: This pun is played on the original Russian words.

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WITHOUT MECHANICAL TREATMENT

The new methods of welding based upon diffusion processes or local melting of the weldable edges, permit the so-called precision welding which assures the production of welded constructions of set and calculated sizes. The welded construction of the future seems to us a perfect and harmonious combination of metal and non-metal parts in finished forms and sizes. Such a construction is free of internal stresses. It does not require any thermal or mechanical treatment. Of course, this is a matter of the far future.

And for the present, we cannot produce welding without deformations. The set sizes and shapes of the welded constructions must be assured by self-adjusting cybernetic systems. Welding benches, machines and automats, adjustable by an electronic brain in accordance with different structural and technological requirements, are in sight.

Further development in welding science will bring computing methods which permit programming of changes in the welding routine and sequence to get the designed quality of the welded construction. In welding larger components or groups of hardly weldable alloys, all the work conditions are still extremely difficult. Therefore, in the first place, welding robots, or even just welding apparatuses, must be created with remote programmed direction.

There is still another branch of welding production where, by the use of the newer achievements of the computing technique, huge savings are made. As well known, a very large volume of the sheet rolled stock, put out by metallurgical factories, is for welded constructions. But before becoming a component in a welded structure, the steel and aluminum sheet is cut out. We do not exaggerate in saying that, just on account of improper cuttings, hundred thousands of tons of metal are scrapped. But, clever cutting of the laminated and profile rolled stock would help our industry to have colossal savings in metal.

In welded constructions of the future, light-weight and durable metals, such as aluminum, titanium, magnesium and lithium, will have the most wide-spread use. They all will squeeze out steel from metal constructions to a great extent. The possibility of a reliable joining of metals with non-metals opens prospects (p. 79) which at the present time are still hard to evaluate properly.

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FOR IMPROVEMENT OF TECHNOLOGY, STRIVE FOR QUALITY

A first-priority task is the creation of principally new welding technological procedures in combination, for instance, with thermomechanical treatment which will assure to get a homogeneously durable weld. Soviet scientists devoted to welding problems came close to the realization of this by this time.

At present, the attention is mostly concentrated upon the higher quality of welded non-standard-size structures. Today, the durability of large welded constructions can be obtained so that the field and assembly type of welding is improved; that the possibly largest volume of welding is transferred to shops which are most favorable for mechanized welding methods. In this field, Soviet scientists had quite a success. As well known, in our country a method was created for the factory preparation of non-standard-size petroleum reservoirs. They have elaborated and are widely using the procedures of mechanized welding of assembly seams on constructions which take the arbitrary position in space.

Much has to be done also to improve the technology and engineering of assembly welding. We suppose that the procedure of building large welded constructions, such as for instance bridges, will change in the future. This will be helped by further progress in the field of aviation, especially in helicopter equipment.

Today the sizes of standard-size individual groups and sections are determined by the conditions of their transportation on railroad or on trucks. But air transportation removes such limitation. The aircraft with a lifting power of hundreds of tons, can get the beam span of a bridge, the fractional column or the atomic reactor directly from the factory to the construction site. But the main volume of welding will be made under the most favorable circumstances, i.e., in factory shops.

In the future development of welding engineering, the methods of controlling the quality of welding also have great importance. It is well-known that when the requirements were raised on welded constructions, many modern non-destructive control methods were created which are based upon modern scientific achievements, such as roentgenoscopy, gamma radiation, betatrons, magnetic defectoscopy, ultrasound vibrations.

In other words, the controllers are outfitted with quite a number of instruments for the detection of defects in welded constructions. But since they check on articles already prepared, the losses which are due to the detection and removal of defects in welded seams, are not infrequently larger than the losses caused by the welding work itself. Nevertheless, (p. 80) this can be avoided by replacing the passive method of control with an active one. The task is to detect no defects in the finished seams, but to avoid them in the welding process. This means that the speed of the control operation must keep up with the speed of welding, in other words, control should be automatic.

A control automat will not only find the defects, but it will also classify time, i.e., it will analyze the information which comes from suitable samples, pickups, from magnetic film or from the screen of an electromagnetic transducer, and it will have an appropriate logical treatment ready. It should send a suitable command to the welding automat to change welding conditions so that a defect in the seam would not be tolerated.

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TO STRENGTHEN THE ALLIANCE OF WELDING AND METALLURGY

With the introduction of welding among the metal-processing industrial branches, large reorganizations were made and will be still made. Thus, on the basis of the electric slag welding procedure, our country created a method which is used in many leading metallurgical factories. It is the method of electric-slag remelting of dissolved electrodes into a water-cooled metal ingot. This way, many thousand tons of metal of very high quality are now gained and set aside for new equipment. The weight of forge ingots reaches 10-12 tons. But this is not the top limit at all. The plan is to build stands for electric-slag melting which are sized for ingots of 40 to 140 tons.

It is well known that in our country the building of powerful converters is the general trend of development in the steel-melting industry for the next 10-20 years. But converter steel cannot always replace open-hearth steel in welding constructions of important allocation. If steel is processed with synthetic slag in steel laddle, then its quality can be brought to conditions characteristic for open-hearth steel and even for electric steel. If however, converter steel is given electric-slag processing, especially in combination with a continuous or semi-continuous pouring of steel, then the effect will be still greater.

Undoubtedly, this is not the limit of the alliance of welding and metallurgy. According to the developmental degree of both production branches, welded shaped will increase, and profiled rolled goods will decrease in importance. By all means, the forms of rolled profiles established during the past decade are not the best. Today, full-flange double (I-beam) is better when welded from separate bars, than when rolled.

By using welding procedures, the metallurgist can create new types of rolled goods: ----multi-layer sheets, profiles which possess the most different characteristics. From multi-layer sheets, welded containers can be manufactured which can do work under the most different conditions. The layer of pulverized refractory metal or non-metal permits the metallurgist to create a fundamentally new construction material.

In the metallurgical production, there seems also a prospective use for the high-temperature plasma arc, for instance, for direct regeneration of iron or other metals, as well as for making refractory joints. The wide use of electron-beam welding opens great prospects for the production of pure metals.

The procedures of preparing bimetallic and polymetallic billets for rolled goods or for other mechanical hot processing can be much reinforced on the basis of the electric-slag procedure, combined with liquid metal pouring. We consider that in this way the former idea of using liquid metal admixture in welding can come true.

But what prevents the wide-spread introduction of welding in rolled goods production? Its low output, and its greater deformation. But when welding speed will increase, and the warping of welded structures will sharply diminish, then their dressing or annealing will not be needed any longer. Welding machines can be erected in metallurgical shops just as well as in mechanical construction shops. The metallurgical factory of the future will be an automated aggregate of continuous function with arrangements for continuous steel pouring (UNRS), with rolling mills, highly efficient welding machines. At the same time, the metallurgical factory will be also a factory of metal construction. This is not a drema, but a reality.

The world of the future is the world of Cosmos. The creation of modern cosmic vessels, super-power rockets which put the vessels into orbit, are simply unthinkable without the use of the newer achievements of welding engineering. Without welding, it would be impossible to make a starting area for interstellar liners, or take-off arrangements on other planets. Therefore, our welders now devote themselves to the problem of welding in deep vacuum (up to 10^{-12} mm Hg), by creating an artificial Cosmos on Earth. They are engaged in problems of welding in an atmosphere of different pressure, i.e., under conditions which are characteristic for "alien" planets.

There was a time when welding was called micrometallurgy. They saw in it something similar to the greater metallurgy. This idea is obsolete at present. Today, from a merely metallurgical procedure welding transformed into a procedure of physical chemistry, not only collecting for itself the newer achievements from the adjacent branches of science and technology, but also enriching those branches. Welding is not a narrow field at all. As Nikita Sergeevich Khrushchev said, it is bound to have a great future. In the world of the future, it will occupy an honorable place among other creative works of the human mind.

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FROM OUR FRIENDS

SCHLESSER, Captain, Engineer, National People's Army, German Democratic Republic

PROTECTION OF WEAPONS FROM CORROSION

(p. 81-82)

In their daily practice, officers of the artillery ordnance service pay much attention to the problem how to protect infantry arms and artillery weapons and instruments from corrosion. In the German Democratic Republic, the generally known methods are widely used to preserve and to restore protective varnish and paint coatings on parts and groups of weapons.

In an effort to increase the durability of paint layer, very carefully we prepared the metal surface before painting. But even after a preliminary sandblasting treatment, the paint started soon to peel off. Such places were usually repainted. The external aspect of the weapon was restored, but the strength of the protective layer was again ruined and corrosion developed under it.

We turned to the experience of industrial enterprises in our republic, and in a short time we started to test a (p. 82) method of preparing metal surfaces for coating which is widely used in our national economy. In this method, the parts are treated with a special solution composed of 15% commercial phosphoric acid, 80% water and 5% contact solution. The metal parts are immersed in a tube with the solution for 5 hours, if the solution's temperature is near 18°C, but only for 30 minutes at temperatures of 30-35°C. Ten liter solution is enough for the treatment of a 6 - 3m^2 steel surface.

The preparation of the parts is extremely simple. From the surface of the part we remove scales and rust, and we coat it with a 2-5 mm layer of porous phosphate. The phosphate layer protects the metal from oxidation while it is not covered nitro-paint. And the porous surface serves as a foundation for paint. It seems also to be beneficial to cover the unpainted, merely dressed steel surface with a layer of phosphate from a sprayer. It is interesting that the solution used for treatment of the parts can be regenerated by addint oxalic acid to it. Under the action of the acid, dissolved iron precipitates as yellow sediment.

In the German Democratic Republic, phosphate treatment is also used at the general overhaul (depot maintenance) of guns. Their gun mounts, shields, and barrels are first subjected to sandblasting treatment. We suppose that by this method anticorrosion coating can be regenerated on artillery charges as well as the painted surfaces of artillery devices can be treated.

Small arms and artillery ordnance which is kept in dead storage is usually coated with a thick layer of lubricant. But, as well known, the process of taking them out of dead storage (de-conservation) is very laborious. The case is somewhat different if the preparation called "leukorrosin" is used which is produced by the national enterprises of the German Democratic Republic. When it contacts air, it forms an invisible

vapor which reliably protects steel and some non-ferrous metal parts from corrosion. Leukorrosin is put on the market in powder form. There is also available a paper impregnated with it. The paper is suitable for packing large parts, and the powder for the preservation of small parts.

Small arms packed in leukorrosin paper are placed in polyvinylchloride bags with welded or pasted seams. In such bags, spare parts are also conveniently kept. Before packing, the metal parts of weapons are coated with a thin layer of gun grease. The weapon which is dead-stored in this manner can keep for many years. In need, the powder is quickly removed, and the weapon is at once ready for operation.

As the tests proved, completely greaseless and partially greased weapons and spare parts with polished and blued surface, dead-stored with the aid of leukorrosin, were well preserved in pasted polyvinylchloride bags under different climatic conditions. After two years' storage in the blueing chamber, in the refrigerator and in the shower room, no trace of corrosion showed on any part.

Experiment was also conducted with gun barrels. The rifled portion of the bore and the powder chamber were completely greaseless, filled with lukorrosin paper, and then the weapon's muzzle end was sealed airtight. After 15 months' preservation in the open air, corrosion was not found either. Leukorrosin paper can be also used for the preservation of metal instruments.

In conclusion, it should be said that the chemical methods of protecting metals from corrosion are progressive, but we do not consider them ideal. Special lubricants with high mechanical strength and plasticity even in a thin layer should be created. Such an agent will permit to considerably decrease the tediousness of work, and to keep weapons in constant combat readiness.

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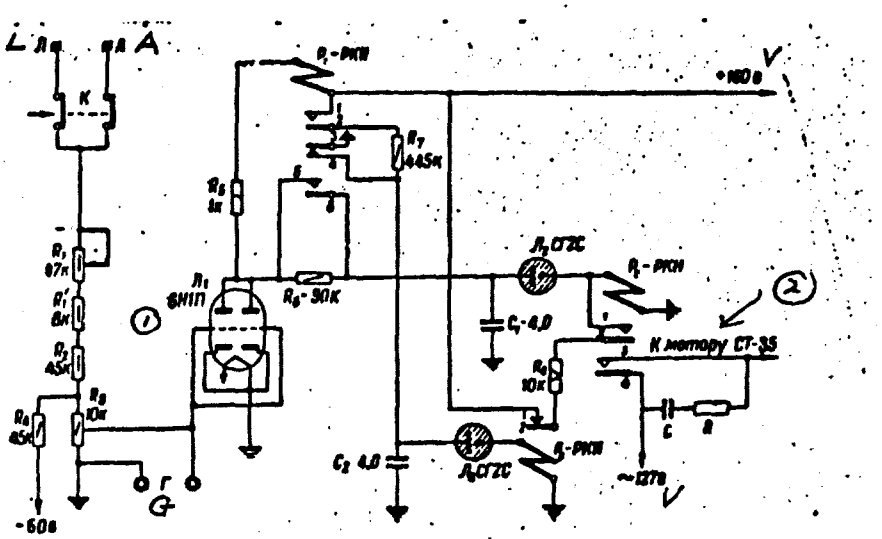
ADVICES AND SUGGESTIONS

MAN"KOV N., Major

AUTOMATIC STOP FOR ST-35 APPARATUSES

p. 83-84

With the automatic stop we designed, one telegraphist on duty can service several ST-35 telegraphic apparatuses which operate by both radio and wire line communication. Let us examine the principle of operation of the automatic stop's circuit (see Figure). The line of communication is connected to Terminal L, and the telegraph apparatus to Terminal A.



(On diagram): 1....6 N 1 P; 2...to motor ST-35)

When current (stop) sending enters from the line, positive voltage is applied to the R_1-R_3 member. This voltage compensates the negative voltage received from the source (-60 V). As a result, zero potential is fed to the grid of Tube L_1. At this, the tube opens, Relay P_1 is carrying the current, its Contacts 1-2 and 5-6 are closed, and Contacts 3-4 are open. Voltage in the order of 130 V, taken off from the anode of Tube L_1, is fed through contacts 5-6 to Capacitor C_1. But it is small, and Stabilitron L_2, and thus also Relay R_2 do not operate.

To start the apparatus, a currentless sending of somewhat longer than 1 sec. duration must be received from the other operator (=correspondent). At such a sending, Tube L_1 is blocked with a -6V negative voltage, and the contacts of Relay P_1 revert to the original position. The voltage on the anode of Tube L_1 grows to 160 V, the charging of Capacitor C_1 starts through Resistances R_5, R_6, and the winding of Relay P_1. Approximately in 1 sec., the capacitor plates' voltage becomes equal to the critical grid voltage of Stabilitron L_2, and its discharges through the

winding of Relay P_2. The relay operates, and through Contacts 1 - 2 of Relays P_2, P_3, the Resistance R_5 is blocked. Contacts 3 - 4 of Relay P_2 enage the motor of the telegraph apparatus.

At the arrival of working sendings from the line at Relay P_1, its contacts switch over in accordance. However, on account of the greater time constant of the R_7C_2 circuit, Relay P_3 does not operate and the blocking of Relay P_2 is not perturbed. To prevent a permanent accumulation of charge on itself, Capacitor C_2 is periodically discharged through Contacts 3-4 and Relay P_1.

When the telegram reception is completed, a lasting current (stop) sending enters from the line. Through Contacts 1-2 of Relay P_1 Capacitor C_2 is gradually charged. After 5 seconds, current passes through Stabilitron L_3, Relay P_3 operates and, with its Contacts 1-2, it breaks the blocking circuit of Relay P_2. The motor circuit of the telegraph apparatus opens, the circuit reverts to its original condition.

If after reception an answering sending must be transmitted, Pushbutto K is pressed for 1-2 seconds: --- a currentless triggering sending will be sent to its own automatic stop and to the automatic stop of the other operator (-correspondent). Circuit R_6C_1 and Stabilitron L_2 retard the operation of Relay P_2. Therefore, the motor of the ST-35 apparatus cannot be accidentally engaged by pulses and interferences in the radio channel. Capacitor C_1 is periodically discharged through Contacts 5-6 of Relay P_1 and the closed Tube L_1.

The automatic stop is fed from dry anode and storage batteries, as well as from the supply feeding unit. When working by radio, all the required feeding voltage can be obtained from the radio receiver.

The automatic stop is adjusted in this manner. In Measuring Socket G, the TT-1 instrument is inserted, Pushbuttom K is pressed, and with Potentiometer R_3, which is brought out under the slit, a 6V voltage is set up. Then, the pushbuttom is released, and, with adjustable Resistance R_1, a zero voltage is set up on the instrument.

In the circuit diagram, RKN (=PKH) relays are used. The operating current of the relay is 9 milliamp., and the winding's resistance is 1000 ohms.

To reduce the current density in Contacts 3-4 of Relay P_2, these contacts are assembled from 3-4 parallel pairs. The quench circuit is selected by experimentation.

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DEMIN, A., Lt. Colonel

TRANSPORTABLE PROJECTOR STATION

p. 84

In our practice, the need arises to quickly change the base to an other airdrome for the APM-90 automobile projector station which is mounted on a ZIL-150 motor car. Its dimensions are such that it cannot be loaded on an airplane.

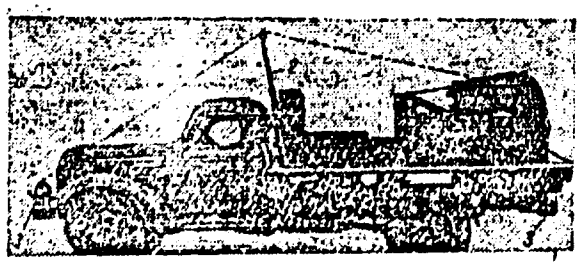

FIGURE 1 - The APM-90 projector station (projector omitted):
1...front winch; 2...support with pulley; 3... rear winch.

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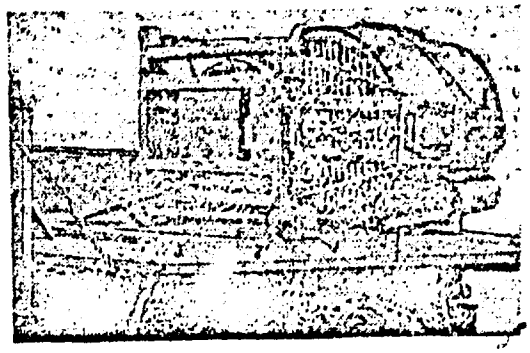

FIGURE 2 - Fastening of the projector to the car platform.

1...immobile ring; 2...mobile ring; 3...shaft

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Our efficiency officers KOTENKOV and LEONAS changed the projector station by command permission. As it can be seen in Figure 1, the car platform remained unchanged. Only from its left side they took off the cargo hold and from the front part of the body they took away the three boxes of spare parts. Earlier the projector frame was immobilized to the car floor with four bolts. Now, the projector is placed closer to the driver's compartment, and it can be put in a position in the body, and closed with flange.

Figure 2 shows the AP,-90 projector in a recumbent position. Two immobile rings (1) are attached to the car platform with bolts. Mobile rings (2) are welded to the projector's frame. In their openings a shaft is inserted on which the projector can also turn. It is lowered and lifted with self-braking worm winches (see Figure 1). One of them is welded

to the bumper of the frame, and the other to the rear frame of the car. The cable of the front winch passes through the pulley of a support, and is fastened to the projector. The cable of the rear winch passes through an opening in the car floor.

The preparation of the projector station for airplane loading needs two persons and 3-5 minutes. First, with the aid of the rear winch the projector is tilted, and the cable of the front winch is continuously lowered. One man lifts the projector with the aid of the front winch. Lifting the projector into working position is facilitated with the aid of a support with incline which is fastened to the car frame. The top part of the support with pulley is taken off when the station is ready for loading. After lifting, the projector is fastened with two bolts to the car platform.

This slight alteration made possible that the AM-20 station can be transported by airplane.

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REVIEWS AND BIBLIOGRAPHY

WHEN THE ROADS ARE BAD FOR TRAVEL

p. 94

Last year, the Military Publishing House released a small pamphlet, entitled "Improvement of Cross Country Ability of the Automobile" **(D.N. IVANOV: Improvement of Cross Country Ability of the Automobil. Milit. Publ. House, 1962, 68 p., Price: 14 kopeks), which is intended for widening the military technical knowledge of officers engaged in automobil operation, and the knowledge of the technically trained drivers.

It is no mere chance that the pamphlet begins with a definition of the concept of "cross country ability" (or roadability). The problem of automobil roadability is at present of great importance, because, as the author states, both in the national economy and in the Army a large number of motor cars operates under difficult road conditions.

In the first chapter the author analyzes the conditions of movement, the moving forces, and the forces which resist automobil movement, the possibilities of overcoming obstacles, and the special features of moving truck trains. A few theoretical problems of automobil movement are popularly explained. Unfortunately, the author talks too much about automobil movement on hard coverings, but hardly touches upon the movement on roads with deformed pavement. And to be sure, this is what we wish to know. Moreover, some explanations are not quite accurate. For instance, it is impossible to understand how the friction losses in the automobil suspension components may influence the resistance to movement (p. 8).

The following chapter is devoted to the description of methods how to improve the cross country ability of automobils. In this chapter, the author talks of the use of chains against skidding, and about other easily demountable do-it-yourself devices to surmount obstacles and to haul out the automobils. At this, the individual methods of improving roadability are explained in a general way only, without indicating the materials from which the different kinds of devices are made. Or, when talking about the depth of a fors passable by automobils (p. 42), the author tells that its roadability can be improved by airtight sealing of several engine points with a special lubricant. But, he does not give the composition of this lubricant.

It cannot be helped also to mention that Figure 6 (p. 26) shows protectors for obsolete tires. It would be desirable to see illustrations of protectors and the technical characteristics for the new tires of Soviet automobils. In the next chapter, recommendations, useful for the military reader, are given about automobil driving on bad roads or cross country-wise.

Even though there are individual shortcomings in the pamphlet, yet on the whole it is interesting, and undoubtedly it will be useful for anyone who uses it at exercises, automobile driving instructions, and teaching truck-train driving under conditions of bad roads.

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NEW BOOKS

The book entitled "Electronic digital computers" (written by Yu. G. CHUGAEV and V.A. PLISKO, and published by the Military Publishing House, 1962, 408 pages, Price 1 rouble), was published for the aid of officers who work with electronic digital computers (EDC) as well as for technicians and for all who wish to get acquainted with these machines.

It introduces the basic characteristics of EDC, the rules of its logical and arithmetic operations.

The authors discuss the computing and control circuits, the arithmetic and memory systems of EDC, the devices for feeding original data to the machine, and the arrangements for the output of calculation results as well as the components of control and feeding. The book exposes the consideration about selections of basic characteristics for the systems, and it describes the methods of repair, adjustment and operation.

Recently, quite a number of books were published which are devoted to the use of ferrites in modern engineering. But almost all of them were intended basically for scientists and engineering workers, aspirants and students of advanced courses, and not for the huge army of operators who work with automatic and radio engineering devices, and not for specialists who must know the physical principles of ferrite apparatuses.

This gap is filled out by the book of N.I. ALPATOV entitled "Ferrites in Electronic Circuits" (Milit. Publ. House), 1962, 112 pages, Price 20 kopeks, which analyzes the ferromagnetic phenomenon and magnetic materials, the fundamental properties of ferrites, and types and procedures of ferrite production as well as it gives information on the use of ferrites in several designs.

The author discusses the ferrite components used in automatic devices and wave guides, he gives a brief description of electronic circuits with ferrites, introduces several types of magnetic amplifiers, switching and memory systems.

The book is of interest to officers, sergeants and soldiers who work with radio engineering installations.

The school manual "Principles of Radio Engineering and Radar" consists of four independent books. **(I. - A.M. KHALASHINKOV, YA. V. STEPYK: Oscillation Systems, 1962, 368 p., Price 77 kopeks.----II. - Z. SLUTSKII: Electric Vacuum Instruments and Pulse Technology, 1962, 388 p., Price 84 kopeks.---- III. - V.G. LEVICHEV, YA.V. STEPUK, B.I. FOGEL'SON: Radio Transmitting and Radio Receiving Devices, 1962, 496 p., Price 1 rouble, 03 kopeks.----IV. - V.Z. SLUTSKIT, B.I. FOGEL'SON, V.G. LEVICHEV, O.G. YAGODIN: Indicators, Rectifiers, and Semi-conductor Instruments, 1961, 356 p., Price 84 kopeks). In these books, together with detailed description of electronic instruments, systems and devices, great attention is paid to the physical side of the arising phenomena. Basically, a mathematical apparatus is used in middle-school program.

These books can serve as aids for students of radio engineering institutes. In addition to this, they are also of great interest to officers who work with radio engineering materiel.

The book of Cand. Techn. Sc., L.G. RAIKOV (Heat of Aircraft during Flight, Series "For the Military Engineering Information", Milit. Publishing House, 1962, 100 p., Price 19 kopeks), explains the principles of the aerodynamic heat theory of modern supersonic aircrafts.

The author pays greater attention to the characteristics of heat sources in the aircraft. He indicates the temperature ranges of supersonic airplanes, rockets and cosmic ships; he describes the properties of materials meant for work under high-temperature conditions, and he introduces data about new materials and coatings which can withstand high thermal loads.

The book also discusses how to take into correct and full consideration the phenomenon of aerodynamic heat at aircraft designing.

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